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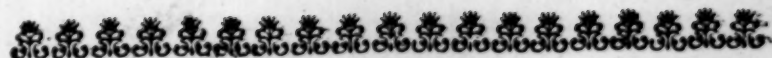
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ARITHMETICK IN EPITOME

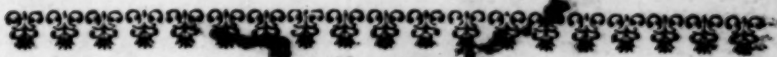
In Two Parts.

By WILLIAM WEBSTER, W. M.

LONDON: ^K

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ARITHMETICK

IN

EPITOME

IN TWO BOOKS

BY WILLIAM BASTON



Printed by H. Mace, for J. Smith, in Westminster-Hall,
at the Sign of the Green and Crown in the Strand,
and at the Sign of the Red Lion in Fleet-Street, and
at the Sign of the Dolphin in Old-Bath.

Price bound in Cloth 6s. 6d. in Sheep 7s.

ARITHMETICK
in

Epitome.

or, a

Compendium
of all its Rules,
both

Vulgar & Decimal.

IN TWO PARTS.

*Intended for the Remembrance, and further
Improvement, of Those who have already made
some Progress in this usefull Science.*

By WILLIAM WEBSTER,
Writing Master & Accomptant,
At the Corner of Cecil Court, on the
Pavement in S.^t Martins Lane.
Where Youth may Board.

ARTHUR METTICK

History of



Constitution

James & Co. London



STANDARD MEASURE

Wm. Smith & Co. London



TO THE
Ingenious Gentlemen,
 THE
 CLERKS *and* ACCOMPTANTS
 OF THE
 Several OFFICES
 OF
 GREAT BRITAIN.

GENTLEMEN;



S. my chief Regard in
 this Attempt, was your
 Service, so I cannot but
 think you the properest
 Patrons of it.

A 3

I know

The DEDICATION.

I know something of this Nature has been much wanted, and therefore hope what is here offer'd, will not be altogether unacceptable.

'Tis a common Complaint, that Books of Arithmetick are very bulky; and indeed not a few are discourag'd by their Length, from their Perusal; but as the many Treatises already printed on this Subject, seem chiefly intended for the Instruction of the utterly ignorant, (tho' of such, scarce one in an hundred is capable of apprehending them) so it is impossible but they must be tediously long; whereas, if Gentlemen are but well acquainted with its first five Rules, (*viz.* Numeration, Addition, Substraction, Multiplication, and Division) half the Words commonly

The DEDICATION. iii

ly us'd, will carry them through the whole Study, and make them compleat Masters of the Science ; as I hope this *Compendium* will in some Measure demonstrate.

You, *Gentlemen*, who are already Proficients, will, I presume, at least find it an useful *Memo-randum*, whilst such who have yet but small Knowledge in Numbers, may, I hope, make an easy Improvement by its plain, yet short Instructions.

As I have made Brevity my Aim throughout the whole, so I have been more particularly short in the first Chapter, of which I suppose my Reader Master ; but all vain Repetitions and useless Tautologies, I have all along most carefully avoided.

iv The DEDICATION

The Method I have us'd, is the nearest that usually taught in Schools, the Rules being rang'd as they are generally there learn'd; and tho' I am sensible *Practice* is not thoroughly to be understood without some Knowledge of *Vulgar Fractions*, yet I have chose to place them in the last Chapter of *Vulgar Arithmetick*, because most common Business may be done by Whole Numbers: However, *Vulgar Fractions* being a distinct Chapter, the Reader may look into them whenever he thinks it most proper.

All that I shall farther urge in its Recommendation, is, that no Care has been wanting in its Correction, nor Charge spar'd to render it compleat. The grand Objection against the Use of *Tables*,
from

The DEDICATION. v

from their Uncertainty, (almost unavoidable in the Letter-Prefs) is here entirely remov'd, they being all exactly engrav'd from my own correct Originals ; and to make them more particularly applicable to the late *Lotteries*, and other Business of the *Exchequer*, their Calculation is carry'd on to 32 Years. The small *Errata* of the other Parts, will, I hope, be excus'd, and the whole Performance kindly accepted from the Hands of

GENTLEMEN,

Your most obedient humble Servant,

William Webster.

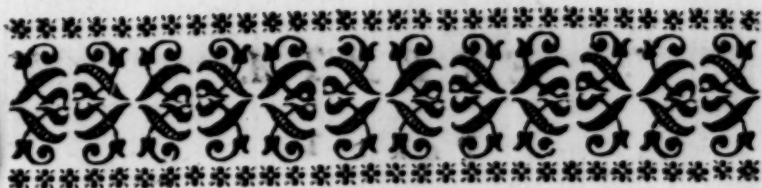
THE DEDICATION

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GENTLEMEN,

Your most obedient humble Servant,

William Bedford.



ON
ARITHMETICK.

HAil, wond'rous Art! ARITHMETICK I mean,
Great as thy self, thy Usefulness has been!
What mighty Genius did thee first invent?
Who to the World first shew'd thy vast Extent?
Sure all the Muses did their Labours join,
And each a Figure form'd so made up NINE;
Which having done, they, as an Emblem, plac'd,
To shew their boundless Use, an endless Space;
A Cypher call'd, expressive Circle! which,
Tho' in it self is nothing, yet does teach,
As by Hieroglyphick, that in those Nine
All that is useful in that Art combine.



ERRATA.

PART I.

Page	Line	For	Read
4	9	10 oz.	11 oz.
29	14	96 C.	96 lb.
42	In the second Example, remove the Line 5276 one Place towards the left.		
50	14	3 s.	12 s.
56	15	1 lb.	1 lb $\frac{1}{4}$
67	18	14 l. 1 s. 10 d.	14 l. 5 s. 10 d.
71	10	2421	1421
ibid.	last	98	198
87	6	08	80
94	last	13	10
103	2	57000	5700
110	Between the Line and 66 rem. of the other Stating, insert 144.		
111	5	Exch. at 53 d.	Exch. at 53 d. $\frac{1}{4}$
119	14	486 l.	846 l.
128	23	5X5X4=14	5+5+4=14
130	19	3	328050
139	21	so many Numbers	so many new Numerators.

PART II.

Page	Line	For	Read
16	10	5765	57691
21	7	6 d.	9 d.
33	In the Example between 1,04 and 500, insert 1,16985856.		
39	8	41,13152	41,13512
52	20	$\frac{82}{65}$	$\frac{16}{25}$
58	7	5257	2457



VULGAR ARITHMETICK

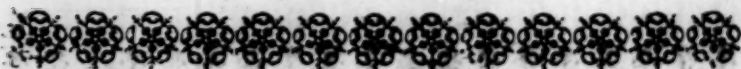
IN

Whole Numbers and Fractions.

PART I.



IS inconsistent with the intended Brevity of this Treatise, to enter upon a nice Enquiry after the first Inventors of this useful Science, or by what Degrees it has been rais'd to its present Perfection. I shall therefore only give this general Definition of it, (*viz.* That it is THE ART OF TRUE RECKONING) and proceed to a particular Explanation of its several Parts.



C H A P. I.

Of the five first, and fundamental Rules.

THE first of which is

NUMERATION, or NOTATION;

by which we learn the different Value of Figures, by their different Places; and, of Consequence, to read or write any Sum, or Number.

The Table.

9	Unites.	1
90	Tens.	12
900	Hundreds.	123
9000	Thousands.	1234
90000	X Thousands.	12345
900000	C. Thousands.	123456
9000000	Millions.	1234567
90000000	X Millions.	12345678
900000000	C. Millions.	123456789

As I suppose my Reader skill'd in more Rules than this, I shall, without farther Explanation, go on to the second, viz.

ADDITION;

A D D I T I O N ;

BY which we find the Whole, or Total, of two or more Parts, or Sums.

For your greater Ease in casting up of Money, learn the following

Pence-Table.

Pence.	s.	d.	Pence.	s.	d.
20	}	1 8	80	}	6 8
30		2 6	90		7 6
40		3 4	100		8 4
50		4 2	110		9 2
60		5 0	120		10 0
70	5 10				

Examples in Whole Numbers and Money.

l.	Yards.	l.	s.	d.	
756	1325	735	18	09	$\frac{1}{4}$
132	4532	423	10	10	$\frac{1}{2}$
458	7345	784	12	05	$\frac{3}{4}$
736	1298	297	08	04	
857	8473	542	11	11	$\frac{1}{2}$
241	5249	298	14	07	$\frac{1}{4}$
3180	28222	3082	17	00	$\frac{1}{4}$ Total.

Proof of Addition

The Proof of this Rule is usually by a second Addition, without the Top-line; which second Total, if which

B 2 Exam.

Examples in Avoirdupoise and Troy-Weights.**Avoirdupoise.**

<i>Tuns.</i>	<i>C.</i>	<i>q.</i>	<i>lb.</i>	<i>oz.</i>	<i>drams.</i>
753	19	3	27	15	15
347	08	1	17	10	06
283	11	0	12	03	10
549	05	2	13	09	07
251	13	0	15	03	11

2185	18	2	02	10	01	Total.
------	----	---	----	----	----	--------

Troy-Weight.

<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>
327	11	19	23
429	10	17	19
274	08	13	09
478	10	12	05
326	09	18	11

1838	04	01	19	Total
------	----	----	----	-------

1510	04	01	20	Tot. without the top-line.
------	----	----	----	----------------------------

1838	04	01	19	Proof.
------	----	----	----	--------

To know how many Drams make an Ounce, or Grains a Penny-weight, &c. (if your Memory fails) see the Tables, Page 15.

Proof of Addition.

The Proof of this Rule is usually by a second Addition, without the Top-line; which second Total, if, when

Vulgar Arithmetick.

when added to the uppermost Line, it makes the first Total, the Work is suppos'd right. See the last Example.

But it is as good, if not a better Proof, to produce the same Total, by adding your Sum both up and down. The next Rule is

SUBTRACTION,

WHICH teaches us, by taking a lesser Number from a greater, to find the Remainder.

Examples in Integers and Money.

Yards.		<i>l.</i>	<i>s.</i>	<i>d.</i>
7146325	Lent	812	13	08 $\frac{1}{4}$
1483972	Paid	196	19	10 $\frac{1}{2}$
Rem. 5662353	Rem.	621	13	09 $\frac{1}{4}$
Proof. 7146325	Proof	812	13	08 $\frac{1}{4}$

	<i>l.</i>	<i>s.</i>	<i>d.</i>
Borrow'd	429	11	08 $\frac{1}{2}$
at several	212	17	10
Times.	356	17	05 $\frac{1}{2}$

Borrow'd in all	999	07	00 $\frac{1}{2}$
Paid	519	18	09 $\frac{1}{2}$
Rem.	479	08	02 $\frac{1}{2}$

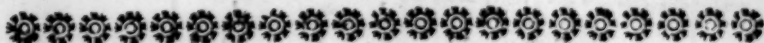
Abstrdupoise.

Tuns.	C.	qrs.	lb	oz.	drams.
92	10	0	07	03	13
14	13	3	11	12	05
77	16	0	23	07	08

Troy-Weight.

lb	oz.	dwt	grs
672	10	05	09
139	11	05	21
532	10	19	12 Remainder.
672	10	05	09 Proof.

Sums in this Rule are easily prov'd, by adding their Remainders to their lesser Numbers; which (if right) will make the greater. See the last Example.

**MULTIPLICATION**

IS the fourth Rule, and serves instead of many Additions; but cannot be well done, without the perfect Knowledge of the following Table.

The TABLE.

3 times	3	9
	4	12
	5	15
	6	18
	7	21
	8	24
4 times	9	27
	4	16
	5	20
	6	24
	7	28
	8	32
5 times	9	36
	5	25
	6	30
	7	35
	8	40
	9	45
6 times	6	36
	7	42
	8	48
	9	54

7 times	7	49
	8	56
	9	63
8 times	8	64
	9	72
9 times	9	81

7 times	7	49
	8	56
	9	63
8 times	8	64
	9	72
9 times	9	81

7 times	7	49
	8	56
	9	63
8 times	8	64
	9	72
9 times	9	81

7 times	7	49
	8	56
	9	63
8 times	8	64
	9	72
9 times	9	81

In this Rule are three Things to be observ'd; the Multiplicand, the Multiplier, and the Product.

The Example shews to which Line each Name belongs.

Example.

Example.

7563254138 Multiplicand.

23456789 Multiplier.

$$\begin{array}{r}
 68069287242 \\
 60506033104 \\
 52942778966 \\
 45379524828 \\
 37816270690 \\
 30253016552 \\
 22689762414 \\
 15126508276 \\
 \hline
 177409656468442882 \text{ Product.}
 \end{array}$$

8+8 Proof.

Proof.

To prove these Sums, cast out the Nines from the Multiplicand and Multiplier, and place the Remainders on the right and left Sides of a Cross, thus made, + These two Figures, multiply'd together, must have the Nines cast out of their Product, and the Remainder plac'd at Top: Then casting the Nines also out of the Product of your Multiplication, place its Remainder at the Bottom; which, if it agrees with the Figure at Top, the Work is right. See the Example.

Or more certain,

A Multiplication Sum is then right, when the Product, divided by the Multiplier, quotes the Multiplicand.

What follows, are some useful

Abbreviations.

(1st.) When either your Multiplicand, or Multiplier, or both, have one or more Cyphers to the right Hand, only multiply by the Figures, and set on the right Hand of the Product so many Cyphers as were in both the Multiplicand and Multiplier.

Ex-

Examples.

527000	7583
4000	7000
2108000000	53081000

(2dly.) Therefore any Number may be multiply'd by 10, 100, 1000, &c. only by placing on the right Hand of it, one, two, three, or more Cyphers: Thus,

7295
Multiply'd by 10, is 72950; by 100 — 729500, &c.

(3dly.) To multiply any Number by 5, add a Cypher to it, and half it. Or by 15, the same; and add both the Lines together.

Examples.

5334 multiply'd	
by 5 — 53340	by 15 — 53340
	26670
is — 26670	is — 80010

(4thly.) Any Number may be multiply'd by 11, 111, or 112, &c. as in the following

Examples.

7136 multiply'd by 11.	By 111, thus:
7136	7136
78496	7136
	792096

There are many Methods of working this Rule. The following Examples divide in several Ways.

(1.) And

And by 112, thus: 7136 Or thus: 7136

$$\begin{array}{r}
 7136 \\
 112 \overline{) 7136} \\
 \underline{7136} \\
 0000 \\
 7136 \\
 \underline{7136} \\
 0000 \\
 799232 \\
 \underline{799232} \\
 00000000
 \end{array}$$

We now proceed to our fifth Rule; or,

DIVISION.

BY which we find how often one Number is contain'd in another.

Here also you must take Notice of four Things, viz. the Divisor, the Dividend, the Quotient, and the Remainder, as in the

Example.

Divisor.	Dividend.	Quotient.
3456789	567895436783	(164284

$$\begin{array}{r}
 22221653 \\
 \underline{14809196} \\
 9820407 \\
 \underline{29068298} \\
 14139863 \\
 \underline{312707}
 \end{array}$$

312707 Remainder.

There are many Methods of working this Rule. The following Example is divided fix several Ways.

(1.)

(1.)	(2.)
$\begin{array}{r} 10(2 \\ 1008(1 \\ 42645(1332 \\ 32222 \\ 338 \end{array}$	$\begin{array}{r} 10(2 \\ 1008(1 \\ 32(42645(1332 \\ 32664 \\ 896 \end{array}$
(3.)	(4.)
$\begin{array}{r} 10(2 \\ 1008(1 \\ 32)42645(1332 \end{array}$	$\begin{array}{r} 21 \\ - \\ .8 \\ 10 \\ 10 \\ 32)42645(1332 \\ 32 \\ 96 \\ 96 \\ 64 \end{array}$
(5.)	(6.)
$\begin{array}{r} 32)42645(1332 \\ 32 \\ 106 \\ 96 \\ 104 \\ 96 \\ .85 \\ 64 \\ 21 \end{array}$	$\begin{array}{r} 32)42645(1332 \\ 106 \\ 104 \\ .85 \\ 21 \end{array}$

Note. The two last, call'd the *Italian Ways*, are most generally us'd.

Mr. *Alingham* has indeed set down nine Ways; but his three others, are so very like the 1st, 2d, and 3d, of these, that they can scarce be call'd different.

Abre-

Abbreviations.

(1st.) If there are any Cyphers on the right Hand of your Divisor, you may cut off so many Cyphers, or Figures, on the right Hand of your Dividend; but remember to bring them down (if Figures) to the Remainder.

Example.

$$\begin{array}{r} 21 \overline{) 00} 8645 \overline{) 29} (411 \\ 84 \end{array}$$

24

21

35

21

1429

(2^d.) When your Divisor is 12, or consists only of one single Figure, or can be reduc'd to one, by cutting off Cyphers from its right Hand, the Work may be easily perform'd in one Line, thus.

Rule.

Drawing a Line under the Dividend, set down under its first Figure, how often the Divisor is contain'd in it; what remains, imagine plac'd before the next Figure; and considering how often your Divisor is contain'd in the Sum it makes, set down the Number underneath, as before; and so proceeding through all the Figures, set down what remains at last, in the Place where your Quotient us'd to stand. See the

Examples.

Examples.

$$\begin{array}{r} 4)93645(1 \\ \hline \end{array}$$

$$23411$$

$$\begin{array}{r} 12)83675(11 \\ \hline \end{array}$$

$$6972$$

$$\begin{array}{r} 7|00)5635|25(\\ \hline \end{array}$$

$$805$$

(3d.) By the two foregoing Rules, you may observe, that to divide by 10, 100, 1000, &c. is only to cut so many Figures from the right Hand of the Dividend, as there are Cyphers in the Divisor.

Example.

$$1'000)43682|735($$

So the Quotient is 43682, the Remainder 735.

If you are to divide several Numbers by one common-Divisor, (as in the calculating of Tables, &c.) that you may know exactly at once how often your Divisor will go, in some convenient Corner, make a Table of your Divisor, by multiplying it severally by all the nine Digits: Thus, suppose 562 your Divisor.

562	1
1124	2
1686	3
2248	4
2810	5
3372	6
3934	7
4496	8
5058	9

Proofs of Division.

(1st.) Multiplication and Division mutually prove each other: For as if you divide the true Product of a Multiplication by the Multiplier, the Quotient will be

C

the

the Multiplicand; so, if you multiply the Quotient of a Division by the Divisor, (taking in the Remainder) the Product will be the Dividend.

(2d.) Another Proof of Division, is by adding together those Lines in the following Example, mark'd with Asterisks, (being the particular Products of the Divisor, multiply'd severally by each Figure in the Quotient) the Total of which (if right) will be the Dividend.

(3d.) Division may also be prov'd as Multiplication, by a Cross, thus: Casting out the Nines from the Divisor and Quotient, place the Remainders on its right and left Sides; then multiplying the two Figures so plac'd together, and casting the Nines from the Product, add what's left to the Remainder of the Division; and still casting out the Nines, let the Overplus be plac'd at Top; then also casting the Nines from the Dividend, set down the Figure remaining at the Bottom; which, if it agrees with that at Top, the Work may be suppos'd right. See each Proof in the

Example.

	736)863256(	1172
	736*	736
	1272	7032
	736*	3516
	5365	8204
	5152*	862592
	2136	664 Remainder.
	1472*	863256 1st Proof.
	664*	
	863256	2d Proof.

Before we proceed to *Reduction*, it will be proper to insert

T A B L E S

TABLES of English Coins,
Weights, and Measures.

First of COINS.

ACCOMPTS are kept in Pounds, Shillings, Pence, and Farthings, thus divided.

$$\begin{array}{l} 4 \text{ Farthings} \\ 12 \text{ Pence} \\ 20 \text{ Shillings} \end{array} \left. \vphantom{\begin{array}{l} 4 \\ 12 \\ 20 \end{array}} \right\} \text{make } \left\{ \begin{array}{l} 1 \text{ Penny,} \\ 1 \text{ Shilling,} \\ 1 \text{ Pound,} \end{array} \right\} \text{thus mark'd } \left\{ \begin{array}{l} d. \\ s. \\ l. \end{array} \right.$$

But the usual Coins are,

$$\begin{array}{l} \text{Of Gold,} \left\{ \begin{array}{l} \text{A Jacobus,} \\ \text{A Carolus,} \\ \text{A Guinea,} \\ \text{A } \frac{1}{2} \text{ Guinea,} \end{array} \right\} \text{Value } \left\{ \begin{array}{l} l. \quad s. \quad d. \\ 1 \quad 5 \quad 6 \\ 1 \quad 3 \quad 6 \\ 1 \quad 1 \quad 6 \\ 0 \quad 10 \quad 9 \end{array} \right. \end{array}$$

$$\begin{array}{l} \text{Of Silver,} \left\{ \begin{array}{l} \text{A Crown,} \\ \text{A } \frac{1}{2} \text{ Crown,} \\ \text{The Names of the rest speak their Value,} \\ \text{as, a Shilling, a Six-pence, a Groat, or 4d.} \\ \text{a Three-pence, a Two-pence, a Penny.} \end{array} \right\} \text{Value; } \left\{ \begin{array}{l} 0 \quad 5 \quad 0 \\ 0 \quad 2 \quad 6 \end{array} \right. \end{array}$$

$$\text{Of Copper, } \left\{ \begin{array}{l} \text{A } \frac{1}{2} \text{ Penny,} \\ \text{A Farthing,} \end{array} \right\} \text{thus writ, } \left\{ \begin{array}{l} 0 \quad 0 \quad 0 \quad \frac{1}{2} \\ 0 \quad 0 \quad 0 \quad \frac{1}{4} \end{array} \right.$$

WEIGHTS.

Troy.

24 Grains }
 20 Pennywts. } make { 1 Pennywt.
 12 Ounces } { 1 Ounce,
 { 1 Pound, } thus mark'd, { dwts.
 { } { oz.
 { } { lb

Apothecaries.

20 Grains }
 3 Scruples } make { 1 Scruple,
 8 Drams } { 1 Dram,
 12 Ounces } { 1 Ounce,
 { 1 Pound, } thus mark'd { ℥
 { } { ʒ
 { } { ʒ
 { } { lb

Avoirdupoise.

16 Drams }
 16 Ounces } make { 1 Ounce,
 28 Pounds } { 1 Pound,
 4 Quarters } { 1 quarter of a Hundred,
 20 Hundred } { 1 Hundred,
 { 1 Tun, } thus mark'd { oz.
 { } { lb
 { } { qrs.
 { } { C.
 { } { Tun

Wool-Weight.

7 Pounds }
 2 Cloves } make { 1 Clove,
 2 Stones } { 1 Stone,
 6 Todds and $\frac{1}{2}$ } { 1 Todd,
 2 Weys } { 1 Wey,
 12 Sacks } { 1 Sack,
 { 1 Last, } mark'd as written.

Lead.

C.

19 $\frac{1}{2}$ makes a Fodder.

MEASURES.

M E A S U R E S.

Wine.

2 Pints	}	make	1 Quart,	}	thus mark'd,	qrt.
4 Quarts,			1 Gallon,			gall.
63 Gallons			1 Hoghead,			hhd.
2 Hogheads			1 Pipe,			Pipe.
2 Pipes			1 Tun,			Tun.

Beer and Ale.

2 Pints	}	make	1 Quart,	}	thus mark'd,	qrt.
4 Quarts			1 Gallon,			gall.
9 Gallons			1 Firkin,			Firkin.
2 Firkins			1 Kilderkin,			Kild.
2 Kilderkins			1 Barrel,			Bar.
3 Barrels			1 Butt,			Butt.

Note, 8 Gallons make 1 Firkin of Ale.

Dry.

8 Pints	}	make	1 Gallon,	}	thus mark'd,	Gall.
2 Gallons			1 Peck,			Peck.
4 Pecks			1 Bushel,			Bush.
4 Bushels			1 Coom,			Coom.
2 Cooms			1 Quarter,			Qr.
5 Quarters			1 Wey,			Wey.
2 Weys			1 Last,			Last.

Long.

3 Barley-Corns	}	make	1 Inch,	}	mark'd as writ.	
12 Inches			1 Foot,			
3 Feet			1 Yard *			
5 Yards and $\frac{1}{2}$			1 Pole or Perch,			* 1760.
40 Poles			1 Furlong,			Yards
8 Furlongs			1 Mile,			make a
						Mile.

Land.

40 Square Perches	}	make	1 Rood.
4 Roods			1 Acre.

Note, That a Geometrical Pace is 5 Feet, and that there are 1056 such Paces in an *English* Mile.

Cloth.

4 Nails	}	make	1 Quarter,	}	mark'd,	{	gr.
4 Quarters			1 Yard,				
							yd.

Note, An *Ell Flemish* is 3 *grs.* An *Ell English* is 5 *grs.*

12	}	make	1 Dozen.
12 Dozen			1 Small Gross.
12 Small			1 Great Gross.

(2d. Sort.)

In 4123788 Farthings, how many Pounds?

$$\begin{array}{r} 4)4123788(\\ \hline \end{array}$$

$$\begin{array}{r} 12)1030947(3 \\ \hline \end{array}$$

$$\begin{array}{r} 20)85912(\\ \hline \end{array}$$

4295 *l.* 12 *s.* 3 *d.* *facit*

We divide here by 4, 12, and 20, for the same Reasons that we multiply'd by them in the other Example.

(3d. Sort.)

Change 45967 French Crowns, at 4 *s.* 6 *d.* each, into Guineas.

$$\begin{array}{r} s. \quad d. \\ 21 \quad 6 \\ 2 \\ \hline \end{array}$$

43

Six-pences
in a Guinea

$$\begin{array}{r} 43)413703(9621 \\ 387 \\ \hline \end{array}$$

267

258

90

86

43

43

0

9 } Six-pences in a
French Crown.
9621 Guineas.

More

More Examples.

In 85647 Guineas, how many Pounds Sterling?

Answer, 92070 l. 10s. 6d.

In 59463 Marks, at 13 s. 4 d. how many Pounds?

Answer, 39642 l.

How many Dollars, at 4 s. 4 d. are there in 89573 Pistoles, at 17 s. 6 d?

Answer, 361737 Dollars, and 6 d. Rem.

In 82 lb. 9 oz. 10 dwts. 5 grs. how many Grains?

Answer, 476885 Grains.

In 56 Tuns, 13 C. 2 grs. 21 lb. 7 oz. 11 Drums, how many Drums?

Answer, 32505211 Drums.

How many Minutes since the Birth of our Saviour, it being 1715 Years?

Answer, 992220 Minutes. The true Total

902021400

How many Gallons are there in 7569 Tuns?

Answer, 1907388 Gallons.

Note, These Questions revers'd, will make as many more good Examples.

CHAP.

222



C H A P. III.

Of the R U L E *of* T H R E E.

WHICH is so call'd, because by Three Numbers given, we find a Fourth, or Number sought.

The chief Difficulty of this R U L E, lies in stating its Questions: For your Direction therefore observe, that of the three given Numbers, two always contain a Supposition, and the third a Demand.

The Number then on which the Demand lies, must always be the third in your stating; of the other two, you will be sure to find one of the same Quality with the said third; which being made your first, the Number left, must, of Consequence, fall in the second Place, which will bear the same Relation to the fourth, (or Number sought) as the first does to the third.

The Question being thus stated, you must (if they are not already so) bring your first and third Numbers into one Name, and your second into its lowest Terms; then multiplying your second and third Numbers together, and dividing the Product by your first, the Quotient will be the Answer of your Question, and of the same Name you left your second Number in. See the Examples.

Examples.

Examples.

What must I give for 122 Ells of Holland, if I pay after the Rate of 34 l. for 138 Ells?

Ells l. Ells.
If 138 cost — 34 — what will 122

The Remainder 8, being Parts of a Pound, are multiply'd by 20, to see what Shillings they will produce; and so the other Remainders, by 12, and 4, to bring out the odd Pence and Farthings.

$$\begin{array}{r}
 34 \\
 \hline
 488 \\
 366 \\
 \hline
 \longrightarrow \text{ l. s. d.} \\
 138)4148(30 \text{ } 1 \text{ } 1 \frac{1}{4} \\
 414 \\
 \hline
 \dots 8 \\
 20 \\
 \hline
 138)160(1 \\
 138 \\
 \hline
 \dots 22 \\
 12 \\
 \hline
 138)264(1 \\
 138 \\
 \hline
 126 \\
 4 \\
 \hline
 138)504(3 \\
 414 \\
 \hline
 \dots 90
 \end{array}$$

How

How many Yards of Muslin can I buy for 42 l. 12 s.
if $2\frac{1}{2}$ Yards comes to 19s. 6d?

s. d.	Yards.	l. s.
If 19 6 buys	$2\frac{1}{2}$	what will 42 12
2	2	20
39	5	852

2)218(

109 Yards

2

1704

 $5\frac{1}{2}$ Yds.

39)8520(218 fa.

78

72

39

330

312

18

Proof.

Sums in this Rule, are prov'd by a back-stating: For

If

l. s. *Yards,* *s. d.*
If 42 12 will buy 109 then 19 6 will buy

20	39	2
852	981	39
2	327	

1704	1704)4251(2 $\frac{1}{2}$
	3408

843
2

1686

18 Remainder of the
other Stating.

1704)1704(1
...0

If you would know at what Rate you must sell out your Goods by Retail, so as to make a propos'd Gain by the whole, add the Money you would gain, to the Sum the whole Goods cost you; and then state your Question thus: If the whole be sold for the total of the Cost and Gain, what must any Part?

Example.

Suppose I would, by the selling of 32 Yards of Broad Cloth, which cost me 40*l.* gain 5*l.* for what must I sell it per Yard?

Yards	l.	Yard.
If 32 be fold for 45, what will 1		
1.	1	
40 Cost.	— l. s. d.	
5 Gain.	32)45(1 8 1 $\frac{1}{2}$ facit.	
—	32	
45 Total.	—	
	13	
	20	
	—	
	32)260(8	
	256	
	—	
	4	
	12	
	—	
	32)48(1	
	32	
	—	
	16	
	4	
	—	
	32)64(2	
	64	
	—	
	0	

Or if Damage having happen'd to the Cloth, 5 l. were to have been lost by the whole, then the said 5 l. must have been subtracted from the Cost, and the Remainder made the second Number, as before.

If you would barter or exchange your Goods for others, first find the Value of your own, and then see what Quantity of the others the Sum will purchase.

Examples.

Examples.

What Quantity of Pepper, at 3 s. 6 d. per lb may I have in Exchange for 426 C. of Tobacco, at 53 s. per C.?

C.	s.	C.
First, if 1	53	426
		53
		1278
		2130
		2257 8
		1128 l. 18 s.

s. d.	lb	l. s.
Then, if 3 6	1	1128 18
2		20
7		22578
		2
		7)45156(6
		6450

Answers

Note.

Some Stratings, whose Numbers happen to be even, may be much shorten'd, by dividing their first and second, or first and third Numbers, by any Figure, so that nothing may remain.

D 2

Example.

Example.

l. *Men.* *l.*
 If 192/00 would pay 5/00 how many would 17664
 Divided by 6)192/00

Divided by 4) 32
 8

Divided by 6— 2944

Divided by 4— 736
 5

8)3680(

Answer, 460 Men

The Reasonsof this Abbreviation may be seen in the fifth Sort of Reduction of Vulgar Fractions.

More Questions in the DIRECT RULE OF THREE.

The Cloathing of a Regiment of 740 Men, comes to 3000*l.* how much is that for each Man?

Answer, 4*l.* 1*s.* 0*d.* $\frac{3}{4}$

How long shall I be laying up 10000*l.* if I put by $\frac{1}{2}$ a Guinea a Week?

Answer, 357 Years, 10 Months, 4 Days.

500 Sea-men are to have 4*d.* $\frac{1}{2}$ per Day each, what will pay them for 23 Months?

Answer, 6037*l.* 10*s.*

What will an Estate of 4000*l.* per Annum, allow a Gentleman to spend a Day?

Answer, 10*l.* 19*s.* 2*d.*

A Gentleman's daily Expences are 13*s.* 7*d.* above which, he yearly lays up 600 Nobles, at 6*s.* 8*d.* each, what is his Estate worth per Annum?

Answer, 447*l.* 17*s.* 11*d.*

A Man

A Man owing 736*l.* 10*s.* compounds with his Creditors for 7*s.* 9*d.* per *l.* what will that amount to?

Answer, 285*l.* 7*s.* 10*d.* $\frac{1}{2}$

If at 5*s.* per Ell, I gain 8*l.* per Cent. by my Cloth, what shall I gain per Cent. if I sell the Ell at 6*s.* 3*d.*?

Answer, 10*l.*

If Tobacco, which cost 13*d.* per *lb.* be sold for 18*d.* per *lb.*, what is gain'd per Cent.

Answer, 27*l.* 15*s.* 6*d.* $\frac{1}{2}$

Bought 5 Pieces of Holland, each containing 56 Ells *Flemish*, at 3*s.* 2*d.* per Ell, what shall I gain in the whole, if I sell it for 5*s.* 8*d.* per Ell *English*?

Answer, 3*l.* 5*s.* 4*d.*

I have by me 96*C.* of Cloves, which cost me 58*l.* but some Damage having happen'd to them, I am willing to lose 8*l.* in the whole; at what Rate must I sell them per Ounce?

Answer, 7*s.* 3*d.*

A Merchant sends over to France 482 Tuns of Lead, at 4*l.* 10*s.* per Fother, i. e. 19 $\frac{1}{2}$ *C.* what Quantity of Wine, at 30*l.* per Pipe, may he expect in Return?

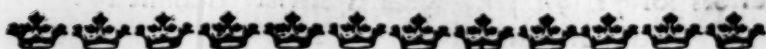
Answer, 74 Pipes, 19 Gallons.

A Merchant sends to Spain 1300 Pieces of Broad Cloth, each Piece 47 Yards, at 15*s.* 6*d.* per Yard, to have Returns from thence; the one half in Wine, at 65*l.* per Tun; the other half in Oranges, at 3*l.* 10*s.* per Chest; what Quantity of each will he have?

Answer, { 394 Tuns, 2 Hogsheads, 26 Gallons of Wine.
6764 Chests of Oranges.

Two Men part, at the same Time from the same Place; the one travels North 32 Miles a Day, the other 36 Miles a Day South, how long will it be before they are 2000 Miles asunder?

Answer, 29 Days, 9 Hours, 52 Minutes.



The Indirect RULE of THREE,

DIFFERS, in its Operation, from the Direct, in that, after the Question is stated, and the Numbers of the Stating prepar'd, your first and second must be multiply'd together, and your third Number be your Divisor. The Quotient, as before, will be the Answer.

Examples.

What Number of Men must be employ'd, to finish, in 12 Days, what 43 Men would be 35 Days about?

Days	Men	Days
If 35	— 43 —	12
43		
105		
140		
12) 1505 (5		
<i>Answer, 125 Men.</i>		

How many Yards of Stuff 3 grs. wide, will hang a Room which requires 420 Yards of 5 grs. wide?

grs.	Yards	grs.
If 5	— 420 —	3
5		
3) 2100 (		
700 Yards		

To know whether a Question belongs to the Direct or Indirect Rule of Three.

Observe. If the third Number, being more than the first Number, requires more; or being less, requires less; 'tis *Direct*; but if the third Number, being more, requires less; or being less, requires more; 'tis *Indirect*.

More Questions in the Indirect Rule of Three.

If I lend A. 136*l.* for 3 Months, how long must I keep 42*l.* of his, to requite my self?

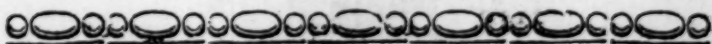
Answer, 9 Months, 2 Weeks, 6 Days.

If 46 Clerks in 32 Days finish a Piece of Writing, in what Time would 55 Clerks accomplish the same?

Answer, 26 Days, 18 Hours, 19 Minutes.

A Garrison consisting of 1539 Men, being besieg'd, have Provisions only for 12 Days; but it being necessary they should hold out 3 Weeks, how many Men must be sent out?

Answer, 660 Men.



The DOUBLE RULE of THREE.

QUESTIONS in this Rule have five Numbers propos'd, and are generally answer'd by two Statings; of which one sometimes happens to be *Indirect*, as in the second Example.

Examples.

Examples.

Example 1.

The Carriage of 32 hundred Weight 56 Miles, comes to 12 s. after the same Rate, what must I pay to have 78 hundred Weight carry'd 94 Miles?

C.	s.	C.
First, if 32	12	78
		12
		s. d.
		32)936(29 3 <i>facit.</i>
		64
		296
		288
		8
Miles	s. d.	Miles
Then, if 56	29 3	94
	12	
		12
		32)96(3
		96
		0
		1404
		3159
		12
		56)32994(589(1
		280
		210(4)9
		499
		448
		514
		504
		10

Note. It had been the same Thing, if the Miles had been made the first and second Numbers of the first Stating; and the C. Weights the first and second Numbers of the last.

Note also, it may be done in one Stating, thus:

C.	s.	C.
If 32	12	78
56 Miles.		94 Miles.

$$\begin{array}{r} 192 \\ 160 \\ \hline 1792 \end{array}$$

$$\begin{array}{r} 312 \\ 702 \\ \hline 7332 \\ 12 \end{array}$$

	s.	d.
1792)87984(49	1	
7168	or	
16304	l. s. d.	
16128	2 9 1	

$$\begin{array}{r} 176 \\ 12 \end{array}$$

$$\begin{array}{r} 1792)21112(11 \\ 1792 \end{array}$$

320

Example

Example 2.

How many Men must be employ'd to reap 420 Acres in 17 Days, if there were requir'd 37 Men to reap 54 Acres in 5 Days?

	Acres	Men	Acres
First, if 54	—	37	— 420
			37
			—
			2940
			1260
			—
Days	Men	Days	
Then, if 5	— 287	— 17	54)15540(287
	5		108
	— Men		—
	17)1435(84 Answer.		474
	136		432
	—		—
	75		420
	68		378
	—		—
	7		42

Note. If you would work such Questions of the *Double Rule of Three*, as have one of their Proportions Indirect, by one Stating; you must multiply the third Number of your Stating, by that Number you would otherwise have plac'd under your first; and your first Number by that you would have plac'd under the third; as in this

Example.

Example.

Acres	Men	Acres	The Number of Days which have relation to the 54 Acres.
If 54	37	420	
* 17		5	
378		2100	
54		37	
918		14700	
		6300	
* The Number		Men.	
of Days which	918	77700	(84 Answer, as before.
have Relation		7344	
to the 420 A-			
crees.		4260	
		3672	
		588	

Dr. Harris, in his *Lexicon Technicum*, teaches another Way of ranging the five Numbers given in a *Double Rule of Three Question*; which, according to the following Rules, gives the Solution, whether the Proportion be direct or indirect. Take this Method in his own Words.

I. " Observing, that the given Terms are always five, whereof three are conditional and antecedent, or suppositious; the other two demand the Question, and are Consequents answering some of the former Antecedents; insomuch, that with the Answer there will be as many Consequents as Antecedents, which must match one another in the same Denomination exactly.

II. " For the right placing of the Question and Terms, the three Terms of the conditional Part are duly to be regarded: Let that which is the principal Cause of Loss or Gain, Increase or Decrease, Action

" or

“ or Passion, be put in the first Place ; and, that which
 “ betokeneth the Space of Time, Distance of Place, &c.
 “ be put in the second Place; and the remaining
 “ Part in the third. The conditional Part thus stated,
 “ the other two Terms, wherein the Demand lies, must
 “ be plac’d so under the former Terms, that they may
 “ correspond one with another.

Rule 1.

“ Then, if the Blank, or Place sought, fall under
 “ the third Term, multiply the three last Terms for a
 “ Dividend, and the two first for a Divisor ; and the
 “ Quotient gives the sixth Term requir’d.

Rule 2.

“ But if the Blank fall under the first or second
 “ Terms, multiply the 1st, 2d, and 5th Terms for a
 “ Dividend, and the 3d and 4th for a Divisor; the
 “ Quotient gives the Answer.

Example 1.

“ If 12 Rods of Ditching be done by 2 Men in
 “ 6 Days, how many Rods shall be wrought by 8 Men
 “ in 24 Days?

Answer 192.

The Numbers being stated as before directed, they
 will stand thus, the Blank falling under the third
 Place.

Men	Days	Rods
2	6	12
8	24	

Therefore

Therefore by the first Rule, the three last Terms, viz. 12, 8, and 24, being multiply'd into each other, give 2304 for a Dividend; and the two first Terms, viz. 2 and 6, multiply'd together, give 12 for a Divisor, which quotes 192, the Answer.

Example 2.

If 2 Men work 12 Rods in 6 Days, how many Men will work 192 Rods in 24 Days?

Men	Days	Rods
2	6	12
	24	192

Here, according to the second Rule, the first, second, and fifth Terms multiply'd, give 2304, which divided by 288, the Product of the third and fourth Numbers, quotes 8, the Answer.

More Examples.

If 400 Pecks of Corn will serve 32 Horses 108 Days, what Quantity will 500 Horses eat in 20 Days?

Answer, 1157 Pecks, 1 qr.

If 56 Gallons of Drink serve 25 Persons 120 Days, how long will 200 Gallons serve 12 Persons?

Answer, 892 Days.





C H A P. IV.

PRACTICE, and TRET and
TARE.

BY PRACTICE Merchants compendiously cast up
the Price of their Commodities.

And by TRET and TARE deduct their Allowances.

Both these Rules will be best explain'd by Examples;
and both require the perfect Knowledge of the follow-
ing

T A B L E.

Of a Pound.		Of a Shilling.		Of a Tun.	
s.	d.	d.		C.	
The Even Parts	1	0	—	2	— $\frac{1}{10}$
	1	8	—	2 $\frac{1}{2}$	— $\frac{1}{5}$
	2	0	—	4	— $\frac{1}{5}$
	2	6	—	5	— $\frac{1}{4}$
	3	4	—	10	— $\frac{1}{2}$
	4	0	—	Of a Hund.	
	5	0	—	lb	
	6	8	—	14	— $\frac{1}{8}$
	10	0	—	16	— $\frac{1}{7}$
				Of $\frac{1}{4}$ C.	
		Of a Penny Far.			
		1	—	7	— $\frac{1}{8}$
		2	—	8	— $\frac{1}{7}$
				14	— $\frac{1}{4}$

Rules

Rules with Examples.

1. When the Price is such a Number of Pence as make an even Part of a Shilling, divide the Quantity of Goods by such Part, and the Quotient will be the Answer in Shillings.

Example.

Suppose you would know the Price of 5296 Ounces of Gum, at 6d. per Ounce; then

$$\begin{array}{r} \text{oz.} \\ 6d. \text{ being } \frac{1}{2} \} 5296 \\ \text{of 1 Shilling.} \} \hline \end{array}$$

2648 Shillings is the Answer.

For were the Price 12d. or 1s. the Number of Ounces would be the Number of Shillings they would cost: Therefore, the Price being 6d. the $\frac{1}{2}$ of a Shilling; the Answer must be but $\frac{1}{2}$ so many Shillings. So, at 1d. 1d. $\frac{1}{2}$, 2d. 3d. or 4d. 'tis but taking the $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, or $\frac{1}{4}$ Parts of the Quantity of Goods, and the Quotient (as aforesaid) will be the Answer in Shillings, which divided by 20, gives the Pounds.

Note. If any thing remains in dividing by the said Parts, (Pence being the next Denomination) it must be multiply'd by 12, the Pence in 1 Shilling; and the Product divided again by the said Part; and if any thing remains there, it must be multiply'd by 4, and still divided by the said Part, to produce Farthings.

Example.

$$\begin{array}{r} \text{oz.} \quad \text{d.} \\ 5243 \text{ at } 1 \frac{1}{2} \text{ per Ounce.} \\ \hline \text{d.} \quad \text{1 } \frac{1}{2} \frac{1}{8} \quad 65 \overline{) 54 \frac{1}{2}} \\ \hline 32l. 15s. 4d. \frac{1}{2} \text{ facit.} \\ \text{E 2} \end{array}$$

2. If

2. If the Pence of the Price are not an even Part of a Shilling, it will require more than one Division, to find the Cost of the Goods. Thus at 5 *d.* or any Number of Pence between 6 and 12.

Examples.

<i>d.</i>	<i>lb</i>	<i>d.</i>	
	527	at 5	per <i>lb</i>
<i>d.</i>	<u>175</u>	8	
4 $\frac{3}{4}$	43	11	
	21	9	7
	10	l.	19s. 7d. facit.

<i>d.</i>	<i>lb</i>	<i>d.</i>	
	436	at 9	per <i>lb</i>
<i>d.</i>	<u>218</u>		
6 $\frac{1}{2}$	109		
	32	7	
	16	l.	7s. facit.

In the first of these, 5 *d.* is taken thus: 4 *d.* is the $\frac{1}{3}$ of a Shilling, or the top Line; and 1 *d.* the $\frac{1}{4}$ of the 4 Pence.

In the second, the $\frac{1}{2}$ of a Shilling is first taken for 6 *d.* and then the $\frac{1}{4}$ of that 6 *d.* for 3 *d.*

3. If the Price is both Pence and Farthings, for the Pence as before, and for the Farthings, take the even Parts of a Penny: thus,

Example.

	<i>oz.</i>	<i>d.</i>	
	532	at 1 $\frac{1}{4}$	per Ounce.
1 Penny,	$\frac{1}{12}$	44	4
1 Farthing,	$\frac{1}{4}$	11	1
	5	5	5
	2	l.	15s. 5d. facit.

4. When

4. When the Price is more than 1 s. and less than 2s. leave the top Line for the Shillings, and take your Parts, as before, for the remaining Pence.

Example.

$$\begin{array}{r}
 \text{lb.} \quad \text{d.} \\
 \text{d.} \quad 5437 \text{ at } 19 \frac{1}{2} \text{ per lb.} \\
 6 \frac{1}{2} \quad 2718 \quad 6 \\
 1 \frac{1}{2} \frac{1}{4} \quad 679 \quad 7 \frac{1}{2} \\
 \hline
 883 \quad 15 \quad 1 \frac{1}{2}
 \end{array}$$

441 l. 15 s. 1 d. $\frac{1}{2}$ facit.

5. If the Price is two or more Shillings, with Pence, &c. either take the even Parts of a Pound from your top Line for the Shillings, which will give you the Price in Pounds; or multiply your top Line by the Number of Shillings, which will give the Answer in Shillings; still working for the Pence as before. See both Ways in the

Example.

$$\begin{array}{r}
 \text{oz.} \quad \text{s. d.} \quad \text{oz.} \quad \text{s. d.} \\
 5263 \text{ at } 2 \quad 6 \text{ per Ounce.} \quad 5263 \text{ at } 2 \quad 6 \text{ per Ounce.} \\
 \text{s. d.} \quad \text{2} \quad \text{2} \\
 2 \quad 6 \quad \frac{1}{2} \quad 657 \quad 17 \quad 6 \\
 \hline
 \text{d.} \quad 10526 \\
 6 \quad \frac{1}{2} \quad 2631 \quad 6 \\
 \hline
 1315 \quad 7 \quad 6
 \end{array}$$

657 l. 17 s. 6 d. facit.

The first of the foregoing Examples is thus done: Had the Price been 1 l. or 20 s. 'tis plain it would have come to as many Pounds as there were Ounces; therefore at 2 s. 6 d. which is the $\frac{1}{5}$ of a Pound, it must come to the $\frac{1}{5}$ of so much Money.

The other is done, by supposing the top Line at 1 s. then for 2 s. it must be twice so much; and for the 6d. $\frac{1}{2}$ the top Line, or Value of a Shilling, must be added. See both Ways in another

Example.

	lb	s.	d.
	5276	at 19	9 per lb
10 $\frac{1}{2}$	2638		
5 $\frac{1}{2}$	1319		
4 $\frac{1}{8}$	1055	4	
6d $\frac{1}{8}$	131	18	
3 $\frac{1}{4}$	65	19	
	5210	l.	1 s. facit.

	lb	s.	d.
	5276	at 19	9 per lb
	19		
	47484		
d.	5276		
6 $\frac{1}{2}$	2638		
3 $\frac{1}{2}$	1319		
	10420	l.	
	5210	l.	1 s. facit.

6. When the Price is any Thing between one and two Pounds, leave the top Line for the Pound, and take your Parts for the Remainder.

Example.

	lb	s.	d.
d.	5384	at 22	6 per lb
2 6 $\frac{1}{8}$	673		
	6057	l.	facit.

7. When the Price is two or more Pounds, multiply the top Line by the Number of Pounds; and for the Remainder, take Parts as before.

Example.

Example.

lb l. s. d.
2364 at 4 18 10 $\frac{1}{2}$ per lb.
4

s.	9456
10 $\frac{1}{2}$	1182
5 $\frac{1}{2}$	591
2 $\frac{1}{2}$	236 8
1 $\frac{1}{2}$	118 4
6d. $\frac{1}{4}$	59 2
3 $\frac{1}{2}$	29 11
1 $\frac{1}{2}$	14 15 6

11687l. 00s. 6d. facit.

8, When with the given Quantity there are odd Parts, such Parts must be taken from the given Price; as in the following

Examples.

C. grs. l. s.
365 2 at 5 5 per C.
5

s.	1825
5 $\frac{1}{4}$	91 5
2 grs. $\frac{1}{2}$	2 12 6

1918l. 17s. 6d. facit.

C. grs. lb l. s. d.
 7365 314 at 8 19 6 per C.
 8

s.	58920			
10 $\frac{1}{2}$	3682	10		
5 $\frac{1}{2}$	1841	5		
4 $\frac{1}{2}$	1473	0		
6 d. $\frac{1}{8}$	184	2	6	
2 grs. $\frac{1}{2}$	4	9	9	
1 $\frac{1}{2}$	2	4	10	$\frac{1}{2}$
14 lb $\frac{1}{2}$	1	2	5	$\frac{1}{4}$

66108 l. 14 s. 6 d. $\frac{3}{4}$ facit.

As in the first of these, for the 2 grs. $\frac{1}{2}$ the Price of the C. is taken ; so in the second, not only $\frac{1}{2}$ the Price of the C. is taken for 2 grs. but also $\frac{1}{2}$ the Price of 2 grs. for 1 gr. and $\frac{1}{2}$ that again for 14 lb. See more

Examples.

Tuns. C. grs. lb l. s. d.
 573 13 2 18 at 9 12 10 per Tun.
 9

	5157			
10 s. $\frac{1}{2}$	286	10		
2 $\frac{1}{2}$	57	06		
10 d. $\frac{1}{2}$	23	17	6	
10 C. $\frac{1}{2}$	4	16	5	
2 $\frac{1}{2}$		19	3	$\frac{1}{4}$
1 $\frac{1}{2}$		09	7	$\frac{1}{2}$
2 grs. $\frac{1}{2}$		04	9	$\frac{3}{4}$
14 lb $\frac{1}{4}$		01	2	$\frac{1}{4}$
2 $\frac{1}{2}$			2	
2 $\frac{1}{2}$			2	

5531 l. 05 s. 1 d. $\frac{3}{4}$ facit.

527 lb

lb oz. drams. l. s. d.
 527 13 15 at 2 8 7 $\frac{1}{2}$ per lb.
 2

1054			
5 s. $\frac{1}{4}$	—	131	15
2 $\frac{1}{10}$	—	52	14
1 $\frac{1}{2}$	—	26	07
6 d. $\frac{1}{2}$	—	13	03 06
1 $\frac{1}{2}$ $\frac{1}{4}$	—	3	05 10 $\frac{1}{2}$
8 oz. $\frac{1}{2}$	—	1	04 03 $\frac{3}{4}$
4 $\frac{1}{2}$	—	12	01 $\frac{3}{4}$
1 $\frac{1}{4}$	—	03	00 $\frac{1}{4}$
8 drs. $\frac{1}{2}$	—	01	06
4 $\frac{1}{2}$	—	—	09
2 $\frac{1}{2}$	—	—	04 $\frac{1}{2}$
1 $\frac{1}{2}$	—	—	02 $\frac{1}{4}$

1283 l. 07 s. 08 d. facit.

The last Sum another Way.

lb oz. drams. l. s. d.
 527 13 15 at 2 8 7 $\frac{1}{2}$ per lb.
 48

4216			
2108			
6 d. $\frac{1}{2}$	—	263	6
1 $\frac{1}{2}$ $\frac{1}{4}$	—	65	10 $\frac{1}{2}$
8 oz. $\frac{1}{2}$	—	24	3 $\frac{3}{4}$
4 $\frac{1}{2}$	—	12	1 $\frac{3}{4}$
1 $\frac{1}{4}$	—	3	0 $\frac{1}{4}$
8 drams $\frac{1}{2}$	—	1	6
4 $\frac{1}{2}$	—	—	9
2 $\frac{1}{2}$	—	—	4 $\frac{1}{2}$
1 $\frac{1}{2}$	—	—	2 $\frac{1}{4}$

2566 | 7 8

1283 l. 7 s. 8 d. facit.

Another

Another Example.

lb	Troy.	oz.	dwt.	grs.	l.	s.	d.
736	11	12	13	at	23	16	4 per lb.
23							
2208							
1472							
10s.	$\frac{1}{2}$	—	368				
5	$\frac{1}{2}$	—	184				
1	$\frac{1}{2}$	—	36	16			
4 d.	$\frac{1}{3}$	—	12	05	4		
6 oz.	$\frac{1}{2}$	—	11	18	2		
4	$\frac{1}{3}$	—	7	18	9	$\frac{1}{4}$	
1	$\frac{1}{4}$	—	1	19	8	$\frac{1}{4}$	
10 dwts.	$\frac{1}{2}$	—	19	10			
2	$\frac{1}{5}$	—	3	11	$\frac{1}{2}$		
12 grs.	$\frac{1}{4}$	—		11	$\frac{3}{4}$		
1	$\frac{1}{12}$	—			$\frac{3}{4}$		

17552 l. 2s. 9d. $\frac{1}{2}$ facit.

By

Vulgar Arithmetick.

47

By the Rule of Three thus:

lb	l. s. d.	lb oz. dwts. grs.
If 1—cost—	23 16 4	what will 736 12 12 13
12	20	12
12	476	8843
20	12	20
240	5716	176872
24		24
960		707491
480		353745
5760		4244941
		5716
		25469646
		4244941
		29714587
		21224705
		57610242640827516(12)421251410
		1224
		2103510412
		720
Facit 17552l. 2s. 10d. $\frac{1}{4}$		17552 2 10 $\frac{1}{4}$
		1448
Three Farthings more than		
by Practice lost there, by		2962
the Fractions remaining.		
		827
		2515
		2116
		4
		57610284614(1
		270

Proof.

Sums in this Rule may be prov'd either by taking the Parts two Ways, as the last Example but one; or by the *Rule of Three*, as the last.

Abbreviations.

As this whole Rule is indeed nothing else, it may be thought strange to mention short Ways here, in a particular Section; but as there are Degrees of Comparison, so even short Ways may be more shorten'd.

1. The Value of any Quantity (the given Price of one of which is an even Number of Shillings) may be most compendiously found, by multiplying the said Quantity by $\frac{1}{2}$ their Number, doubling the Units of the first Product for Shillings, the rest being Pounds.

Example.

5276 Ells of Holland, at 8 s. per Ell.

4

2110:8 Answer.

2. If the Price is an odd Number of Shillings, it is but doing as before, and adding $\frac{1}{2}$ of the top Line to the Product.

Example.

Yards. s.

5278 at 15 per Yard.

7

3694:12

13, $\frac{1}{2}$ 263:18

3958 l. 10 s. Answer.

3. Were

3. Were there Pence in the Price, their Parts might also be easily taken in the same Method.

Example.

	lb	s. d.
	5384	at 7 7 $\frac{1}{2}$ per lb
	3	
	1615	4
1 s. $\frac{1}{10}$	269	4
6 d. $\frac{1}{2}$	134	12
1 $\frac{1}{2}$ $\frac{1}{4}$	33	13
	2052 l.	13 s. facit.

4. Another short and useful Way, when the Quantity is small, is to multiply the Price by it; thus if your Quantity is express'd by one Figure, 'tis done by one Line.

Example.

	l. s. d.
5 Yards of Velvet at	1 13 6 per Yard.
	5
	8 l. 7 s. 6 d. facit.

5. So any Quantity that can be express'd by 2 Figures, and some of 3, may be easily and speedily done thus: Find out what two Figures multiply'd together, will produce the given Quantity, (as suppose 32 Yards or Pounds, &c. the given Quantity, which is produc'd by the Multiplication of 8 by 4) and multiply the Price by one of the said Figures; and the Product of that, multiply'd again by the other, will give the Answer.

Examples.

Yards. s. d.
32 at 15 8 $\frac{1}{8}$ per Yard.

The Value of 8 Yards 6 5 8—
which multiply'd by 4

gives 25 l. 2s. 8d. the Price of 32 Yards
—4 times 8 being 32

Yards. l. s. d.
144 at 1 5 6 per Yard.

12

15 6 0

183 l. 3 s. 0 d. facit.

6. If no two Figures will exactly produce those given, take such as will give the nearest Product to them; which will generally be within one or two, more or less; the Value of which must be accordingly added or subtracted.

Example.

lb l. s. d.
55 at 1 10 9 per Ell.

9

the Price of 9 lb 13 16 9
which multiply by 6

gives the Price of 54 lb 83 00 6
to which the Price of 1 lb added 1 10 9

84 11 3 the Value of 55
So

So had it been multiply'd by 7 and 8, which would have given the Value of 56 lb too much by 1 lb, the Price of 1 lb must have been substracted.

7. If the Quantity has odd Parts, it will be easy taking the Value of such Parts from the given Price; as in the following

Example.

Yds. l. s. d.
43 $\frac{1}{2}$ at 2 12 7 per Yard.

7
—
18 8 1
6

—
110 8 6

grs. 2 12 7
2 $\frac{1}{2}$ 1 6 3 $\frac{1}{2}$

—
114 l. 7 s. 4 $\frac{1}{2}$ facit.



T R E T T and T A R E,

ARE Allowances made to Merchants in buying their Goods.

Tare, of what they can agree for *per* the Whole, *per* Chest, &c. or *per* C. for the Weight of the Bag, Box, Chest, &c. which contains them.

Trett, for the Waste, Moats, or Dust among them; being always 4 lb *per* 104 lb.

There is also another Allowance sometimes given of 2 lb for every 3 C. for the Turn of the Scale, call'd Cloff, or Clough.

Note. The whole Weight, before any Allowances are made, is call'd Gross; when Part is deducted, the

F 2

Remainder

Remainder is call'd Suttle; but when all are taken from it, what's left, is call'd Neat.

Rules with Examples.

1. The Tare of any Quantity of Goods may easily be found, if at so much in the whole, only by subtracting the said Allowance from the Gross Weight; if at so much *per Chest, &c.* by multiplying the Pounds Tare by the Number of Chests, &c. and subtracting as before; and if at so much *per C.* by taking such Part, or Parts of the Gross Weight, as the Allowance is of a C.

Examples.

First Sort. Suppose 15 C. 2 qrs. 13 l. Tare, were allow'd on 456 C. 1 qr. 19 lb of Tobacco, what would be the Neat Weight.

C. qrs. lb
From 456 1 19 Gross.
Subtract 15 2 13 Tare.

Remainder 440 3 6 Neat.

Second Sort. What's the Neat Weight of 3 Frails of Raisins, each weighing 3 C. 2 qrs. 10 lb Gross; Tare at 20 l. *per Frail.*

C. qrs. lb	lb
3 2 10	20
3 Frails.	3 Frails.
10 3 2 Gross.	60 lb or 2 qrs. 4 lb
2 4 Tare.	
10 0 26 Neat.	

Third

	C.	qrs.	lb	lb
Third Sort.	246	3	12	Gross.
Tare	14	$\frac{1}{8}$	30	3 12 Tare.
	216	0	00	Neat.

	C.	qrs.	lb	lb
Again,	364	1	19	Gross.
Tare	16	$\frac{1}{7}$	52	0 06 $\frac{1}{2}$ Tare.
	312	1	12	$\frac{1}{2}$ Neat.

14 or 16 Pounds may be call'd the Standards of Tare ; for from them may any other Number of Pounds, more or less, be taken, as in the following

Examples.

	C.	qrs.	lb	lb
	573	2	13	Gross.
Tare	14	$\frac{1}{8}$	71	2 22 $\frac{1}{8}$
	2	$\frac{1}{7}$	10	0 27
	1	$\frac{1}{2}$	5	0 13 $\frac{1}{2}$
	87	0	07	Tare.
	486	2	06	Neat.

	C.	qrs.	lb		lb
	548	3	11	Gross.	Tare 10 per C.
lb					
16 $\frac{1}{7}$	78	1	17 $\frac{1}{2}$		
8 $\frac{1}{2}$	39	0	22 $\frac{3}{4}$		
2 $\frac{1}{4}$	9	3	05 $\frac{1}{2}$		
	49	0	00 $\frac{1}{4}$	Tare.	
	499	3	10 $\frac{3}{4}$	Neat,	

Note. 'Tis first found what Tare 16 lb would produce; because 8 lb being the $\frac{1}{4}$ Part of a C. would be a troublesome Divisor.

2. TRET being always 4 lb per 104 lb the constant Method of finding it, is by taking the $\frac{1}{26}$ Part of the Line it is to be deducted from, 4 times 26 being 104.

Examples.

	C.	qrs.	lb		lb	lb
	428	1	19	Gross.	Trett 4 per 104	
lb						
4 $\frac{1}{16}$	16	1	25 $\frac{1}{2}$	Trett.		
facit	411	3	21 $\frac{1}{2}$	Near.		

		C.	qrs.	lb		lb
		836	2	17	Gross.	Tare 22 per C.
lb						
16	$\frac{1}{7}$	119	2	2	$\frac{1}{4}$	Trett 4 lb per 104 lb.
4	$\frac{4}{4}$	29	3	14	$\frac{1}{2}$	
2	$\frac{1}{2}$	14	3	21	$\frac{1}{4}$	
		164	1	10	Tare.	
		672	1	07	Suttle.	
lb						
4	$\frac{1}{28}$	25	3	12	Trett.	
		646	1	23	Neat.	
facit						

3. Clough (which is 2 lb for every 3 C.) is found, by first dividing the hundreds of the Line it is to be taken from by 3, which brings them into 3 C's; then 2 lb being to be allow'd for every 3 C. as many 3 C's as it produces, so many 2 lb's it will allow; then dividing by 56, (the double Pounds in a Hundred) the Quotient will be Hundreds, and the Remainder double Pounds; to which adding what may be allow'd for the odd Hundreds, Quarters, and Pounds of the given Weight, it makes the whole Clough; which subtracted from the said given Weight, leaves the Neat.

Examples.

Examples.

C.	qrs.	lb		lb	C.
5647	3	13	Gros.	Clough	2 for 3
33	2	13	$\frac{1}{4}$	Clough.	3)5647(1
					C. qrs. lb
5614	0	27	$\frac{3}{4}$	Neat.	56)1882(33
					2 12
					1 4

202	33	2	13	$\frac{1}{4}$
168				

14	34(2
28	

Note. The Remainder 34 (which are double Pounds) is divided by 14, (the double Pounds in a qr.) to bring the said Remainder into Quarters of an Hundred.

Note also. The 1 lb is allow'd for the odd Hundred, 3 qrs. and 13 lb.

Example 2.

What's the Neat Weight of 3 Hogheads of Tobacco weighing, viz.

Number C. grs. lb

1		5	3	18
2		4	2	11
3		5	1	19

15 3 20 Grofs.

Tare 7 lb per C.

lb

14		1	3	27
----	--	---	---	----

Trett 4 lb per 103 lb

Clough 2 lb for 3 C.

7		1/2	3	27	1/2 Tare.
---	--	-----	---	----	-----------

14 3 20 1/2 Suttle.

4		1/2	2	8	1/4 Trett.
---	--	-----	---	---	------------

14 1 12 1/4 Suttle.

9 Clough

C.

3)14(4

14		1	3	1/4 Neat.
----	--	---	---	-----------

2





CHAP. V.

Of INTEREST.

Interest is either { Simple, { which arises only from the
 or Principal.
 Compound, { which arises both from Principal and Interest.

Simple Interest.

It is work'd as in the following

Examples.

Example 1. What's the Interest of 429 l. for a Year
 at 6 l. per Cent. per Annum?

If 100 — $\frac{4}{6}$ — 429
6

Facit 25 l. 14 s. 9 d. $\frac{1}{2}$

25 | 74
20

14 | 80

12

9 | 60

4

2 | 40

To find the Interest of any Sum for 2 or more Years, multiply the Year's Amount by the Number of Years requir'd.

Note. The cutting off two Figures to the right Hand, divides the Lines so done by 100. See Abreviations of Division.

Ex. 2. What's the Interest of 572 l. for 8 Months, at 5 l. per Cent. per Annum?

l.	l.	l.	l.	s.
If 100 —	5 —	572		
	5	M.	28	12
	—	6 $\frac{1}{2}$	14	6
	28 60	2 $\frac{1}{3}$	4	15 4
	20			
	—		19 l. 1 s. 4 d. fac.	
	12 00			

If the Time is Weeks, or Days, instead of taking the even Parts of a Year, as for Months, it must be done by a *Rule of Three Stating*.

Ex. 1.

Vulgar Arithmetick.

Ex. 1. What's the Interest of 321 l. 16 s. 8 d. for 3 Weeks, at 6 l. per Cent. per Annum?

	l.	l.	l.	s.	d.
If 100	— 6 —	321	16	8	
					6

19	31	00	0
	20		

Facit 19 l. 6 s. 2 d. $\frac{1}{4}$ for a Year. —

6	20
---	----

12

2	40
---	----

4

1	60
---	----

Weeks.	l.	s.	d.	Weeks.
Then, if 52	— 19	6	2 $\frac{1}{4}$	— 3
	20			

386

12

4634

4

18537

3	4
---	---

52	55611	(1069	1
----	-------	-------	---

52

12	267	3
----	-----	---

361

312

2	2
---	---

1 l. 2 s. 3 d. $\frac{1}{4}$ facit.

491

468

23

Ex. 2.

Ex. 2. What Interest is now due on a Bond of 420 l . 10s. commencing Interest at 5 l . 10s. per Cent. per Annum, July the 10th, 1713; this being March the 25th 1715?

l . l . s. l . s.
If 100 — 5 10 — 420 10

5
—
s. 21 02 10
10 $\frac{1}{2}$ 210 5

23 12 15
20

23 l . 2s. 6d. $\frac{1}{2}$
for a Year.

2 55
12

6 60
4

2 40

July — 21
August — 31
September — 30
October — 31
November — 30
December — 31
January — 31
February — 28
March — 25
—
258.

Then
and Money in it, and the Time Weeks or Days.

Rule.

Bring your Sum into Pence, and multiply it by the Number of Days; and if it be 100 Pence, divide the

Days.	l. s. d.	Days.
Then, if 365	23 2 6 $\frac{1}{2}$	258
	20	
	462	
	12	
	5550	
	4	
	22202	
	258	
	177616	
	111010	
	44404	
	4	
365)5728116	(15693(1	
365		
	12)3923(11	
2078		
1825	210)3216	
2531	16l. 6s. 11d. $\frac{1}{4}$ for 258 Days	
2190	23l. 2s. 6d. $\frac{1}{2}$ for a Year.	
	2	
3411	39l. 9s. 5d. $\frac{3}{4}$ total Interest	
3285		
1266		
1095		
171		

Another Way to cast up Interest, when the Principal has odd Money in it, and the Time Weeks or Days.

Rule.

Bring your Sum into Pence, and multiply it by the Number of Days; and, if at 5 l. per Cent. divide the

the Product by 7300, the Quotient gives the Answer in Pence. *Note.* The Number 7300 is found by multiplying 365 by 100, and dividing by 5.

Example.

What's the Interest of 432 l. 12 s. 6 d. for 8 Days, at 5 l. per Cent. per Annum?

$$\begin{array}{r}
 \text{l.} \quad \text{s.} \quad \text{d.} \\
 432 \quad 12 \quad 6 \\
 \hline
 20 \quad \text{---} \\
 8652 \quad \text{---} \\
 12 \quad \text{---} \\
 103830 \quad \text{---} \\
 8 \quad 12 \quad \text{---} \\
 \hline
 73 \overline{) 830640} (1135 \quad \text{---} \\
 \underline{73} \quad \text{---} \quad 9 \text{ s. } 5 \text{ d. } \frac{1}{2} \text{ facit.} \quad \text{---} \\
 100 \quad \text{---} \\
 \underline{73} \quad \text{---} \\
 276 \quad \text{---} \\
 \underline{219} \quad \text{---} \\
 5740 \quad \text{---} \\
 4 \quad \text{---} \\
 73 \overline{) 22960} (3 \quad \text{---} \\
 \underline{219} \quad \text{---} \\
 10 \quad \text{---}
 \end{array}$$

If you would cast up Interest at 6 l. per Cent. by this Rule, you must add $\frac{1}{5}$ of the Quotient, to the Interest produc'd at 5 l. per Cent. and so at other Rates, it is but adding or subtracting such and such Parts of the Quotient

tient to or from what it produces at 5 l. For Instance,
suppose the last Question done by the common Way for
an

Example.

l. s.
420 10 Principal.

20

8410

12

100920 Pence.

623 the Number of Days.

302760

201840

605520

73|00628731|60(8612 $\frac{1}{4}$
584 10s. $\frac{1}{4}$ 861

447 12)9473(5

438

78|9

93

73

39 l. 9 s. 5 d. $\frac{3}{4}$ facit.

201

146

5560

4

73|00222|40(3

219

3

Note.

Note. The Rate here being 5*l.* 10*s.* and 10*s.* being the $\frac{1}{10}$ of 5*l.* there is therefore added $\frac{1}{10}$ of the Quotient, or the Amount, at 5*l.* per Cent.

More Examples in Simple Interest.

At 6*l.* per Cent. what will 589*l.* come to in a Year?

Answer, 35*l.* 6*s.* 9*d.* $\frac{1}{4}$

What will the same Sum, at the same Rate, amount to in 8 Years?

Answer, 282*l.* 14*s.* 4*d.*

What's the Interest of 7020*l.* for 5 Months, at 5*l.* per Cent. per Annum?

Answer, 146*l.* 5*s.*

What is a Week's Interest of 1000*l.* at 7*l.* per Cent.

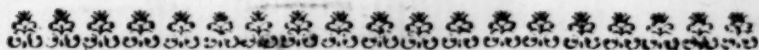
Answer, 1*l.* 6*s.* 10*d.*

What will the Interest of 5429*l.* 10*s.* 8*d.* come to in 20 Days, at 5*l.* per Cent.

Answer, 14*l.* 17*s.* 6*d.*

What Interest is now due on a Navy-Bill, commencing Interest at 6*l.* per Cent. per Annum, June the 4th, 1712, this being January the 10th, 1714, the Principal being 836?

Answer, 80*l.* 7*s.* 10*d.*



Compound Interest,

AS was before said, arises both from the Principal and Interest, (*i. e.*) when Interest on Money becoming due, and not paid, the same Rate is allow'd on the unpaid Interest, as was before on the Principal.

Therefore, to work Sums in this Rule, after having found the first Year's Interest, as before, add it to the

G 3

Principal,

Principal, and find the Interest of the Sum; and so continue to add every Year's Produce, still accounting the Sum a new Principal.

Example.

What will be the Amount of 400*l.* forborn 3 Years and $\frac{1}{2}$, at 6*l.* per Cent. per Annum, Compound Interest?

$$\begin{array}{r} \text{l.} \quad \text{l.} \quad \text{l.} \\ \text{If } 100 \text{ --- } 6 \text{ --- } 400 \\ \quad \quad \quad 6 \end{array}$$

$$\begin{array}{r} \text{l. } 24 | 00 \\ \hline \end{array}$$

$$\begin{array}{r} \text{l.} \quad \text{l.} \quad \text{l.} \\ \text{If } 100 \text{ --- } 6 \text{ --- } 424 \\ \quad \quad \quad 6 \end{array}$$

$$\begin{array}{r} \text{l. } 25 | 44 \\ \hline 20 \end{array}$$

$$\begin{array}{r} \text{l. } 8 | 80 \end{array}$$

$$\begin{array}{r} 12 \\ \hline \end{array}$$

$$\begin{array}{r} \text{l. } 9 | 60 \end{array}$$

$$\begin{array}{r} 4 \\ \hline \end{array}$$

$$\begin{array}{r} 2 | 40 \end{array}$$

Compound Interest

A 2 was before said, write both the Principal and Interest. (i. e.) when Interest on Money is compounding due, and not paid, the same is added on the original Interest, as was before said, after has the Principal, to work upon in the next, after has the same the first Year's Interest, as before, add it to the Principal.

Vulgar Arithmetic.

867

$$\begin{array}{r} \text{If } 100 \text{ --- } 6 \text{ --- } 449 \text{ } 8 \text{ } 9 \text{ } \frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} 1.26 | 96 \text{ } 12 \text{ } 9 \\ \hline \end{array}$$

$$\begin{array}{r} 1.19 | 32 \\ \hline 12 \end{array}$$

$$\begin{array}{r} 4. \text{ } 3 | 93 \\ \hline \end{array}$$

$$\begin{array}{r} 3 | 72 \\ \hline \end{array}$$

$$\begin{array}{r} \text{If } 100 \text{ --- } 6 \text{ --- } 476 \text{ } 8 \text{ } 1 \text{ } \frac{1}{6} \\ \hline \end{array}$$

$$\begin{array}{r} \text{M. } 6 \text{ } \frac{1}{2} \text{ } 14 \text{ } 1 \text{ } 10 \\ \hline 476 \text{ } 8 \text{ } 1 \text{ } \frac{1}{4} \end{array}$$

total Amount.

$$\begin{array}{r} 1.28 | 58 \text{ } 8 \text{ } 7 \text{ } \frac{1}{2} \\ \hline 20 \\ \hline 1.11 | 68 \\ \hline 12 \\ \hline 4.8 | 23 \\ \hline 4 \\ \hline 94 \end{array}$$

CHAP.

On

Or, more plain :

	<i>l.</i>	<i>s.</i>	<i>d.</i>
Interest the 1st Year	24	0	0
2d	25	8	9 $\frac{1}{2}$
3d	26	19	3 $\frac{1}{4}$
$\frac{1}{2}$ Year	14	5	10

Total Interest	90	13	11 $\frac{1}{4}$
Principal	400	0	0

Total Amount. 490 13 11 $\frac{1}{4}$ **More Examples.**

What will 1000*l.* amount to in 3 Years, at 6*l.* per Cent. per Annum, Compound-Interest?

Answer, 1191 *l.* 0*s.* 3*d.* $\frac{3}{4}$

At 5*l.* 10*s.* per Cent. per Annum, Compound Interest, what will 560*l.* 10*s.* 9*d.* amount to, forborn 5 Years and an half?

Answer, 752 *l.* 14*s.* 10*d.* $\frac{1}{2}$





CHAP. VI.

REBATE, *or* DISCOUNT,

IS the abating so much Money on a Debt paid before 'tis due, as might be gain'd again by the Money receiv'd, if put out to Interest at the same Rate, and for the same Time. So 100*l.* present Money, would discharge a Debt of 106*l.* due at a Year to come; Rebate being made at 6*l. per Cent.* because 100*l.* put out to Interest for a Year, at the said Rate, would regain the 6*l.*

To work Sums in this RULE.

First find the Interest of 100 *l.* for the Time; then by a *Rule of Three* stating, of which the first Number must be 100*l.* with the Interest found; the second Number the Interest alone; (or 100*l.* alone, if you would find the present Money) and the third, the Debt, or Sum propounded, you will find the Answer.

Example.

Examples.

Ex. 1. What's the Rebate of 420 l. for a Year, at 6 l. per Cent. per Annum?

If 106 — 6 — 420

106)2520(23

212

400

318

82

20

106

106

106

106

106

106

106

106

106

106

106

106

106

106

106

106

106

106

106

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106

106

106

Ex. 2. What present Money will discharge a Debt of 732 l. due at 3 Months Rebate, being made at 6 l. per Cent. per Annum?

6 Interest for a Year of 100

Months—

3 $\frac{1}{4}$ 1 10

Then, if 101 10 fall to 100, what will 732

$$\begin{array}{r} 2 \\ \hline 203 \end{array}$$

$$\begin{array}{r} 2 \\ \hline 203)146400(721 \\ 2421 \end{array}$$

$$\begin{array}{r} 430 \\ 406 \end{array}$$

$$\begin{array}{r} 240 \\ 203 \end{array}$$

$$\begin{array}{r} 37 \\ 20 \end{array}$$

$$\begin{array}{r} 203)740(3 \\ 609 \end{array}$$

$$\begin{array}{r} 131 \\ 12 \end{array}$$

$$\begin{array}{r} 203)1572(7 \\ 1421 \end{array}$$

$$\begin{array}{r} 151 \\ 4 \end{array}$$

$$\begin{array}{r} 203)604(2 \\ 406 \end{array}$$

$$98$$

Ans. 721 l. 3 s. 7 d. $\frac{1}{2}$

Ex. 3.

l. s. d.	s. d.	l. s.
Then, if 100 18 0 $\frac{3}{4}$	18 0 $\frac{3}{4}$	85 10
20	12	20
2018	216	1710
12	4	12
24216	867	20520
4		4
96867		82080
		867
		574560
		492480
		656640
		4
	96867	71163360 (734(2
	678069	12(183(3
	335646	290601
	290601	15s. 3d. $\frac{1}{4}$
	450450	
	387463	
	62982	

Answer, 15s. 3d. $\frac{1}{4}$

Ex. 4. A Bill of Exchange for 250*l.* is dated at *Amsterdam*, June the 13th New Stile; at *Ufance* is accepted, and Payment offer'd the 15th ditto Old Stile, what must be then receiv'd, Rebate being made at 6*l.* per Cent. per Annum?

Note. New Stile is 11 Days before Old Stile.

Ufance signifies a Month, double *Ufance*, two Months, &c. Note also, Merchants of *London* generally allow 3 Days beyond the Time appointed, calling them 3 Days of Grace. Therefore the Bill being dated June the 13th, N. S. or the 2^d, O. S. and accepted at

H Ufance,

Ufance, or a Month; it becomes due *July* the 2d, O. S. but 3 Days of Grace being allow'd, makes it the 6th. So if the Money is paid the 15th of *June*, O. S. Rebate must be made for 21 Days. Then,

Days.	l.	Days.
If 365	— 6 —	21
		6
		126
		20
		5.
		365)2520(6
		2190
		330
		12
		d.
Facit 6s. 10d. $\frac{3}{4}$		365)3960(10
		365
		310
		4
		365)1240(3
		1095
		145

Note. A Bill of Exchange for 2000 l. is due at 10 Days before Old Style. But the 15th New Style is the 10th Old Style. And Payment should be made on the 15th New Style. Rebate being made at 6s. per Cent. per Annum.

Note. New Style is 11 Days before Old Style. Ufance signifies a Month, double Ufance, two Months, &c. Note also Merchants of London generally allow 3 Days beyond the Time appointed, calling them 3 Days of Grace. Therefore the Bill being dated June the 15th, M. S. or the 2d, O. S. and accepted at Ufance,

Wichtiges Arithmetisch.

75

$\begin{array}{r} l. \quad s. \quad d. \qquad \qquad \qquad l. \qquad \qquad \qquad l. \\ \text{If } 100 \text{ } 6 \text{ } 10 \frac{3}{4} \text{ --- } 100 \text{ --- } 250 \end{array}$

20

20

2006

5000

12

12

24080

60000

4

4

96323

96323)24000000(249

142646

47-2540

285202

88,480

866005

• 15572

20

06222)217460/2

288460

'22491

14

Answer, 2491. 36. 2 d. 3

96222)260802(2

102646

77246

A

06222)208084(2

388060

• 2091-5

More Examples.

What's the Rebate of 100*l.* for $\frac{1}{2}$ a Year at 6*l.* per Cent. per Annum?

Answer, 2*l.* 18*s.* 3*d.*

What's the Rebate of 538*l.* 10*s.* for 5 Months, at 5*l.* per Cent. per Annum?

Answer, 10*l.* 19*s.* 9*d.* $\frac{1}{2}$

What present Money is a Debt of 629*l.* due at 3 Weeks worth, Rebate being made after the Rate of 6*l.* 10*s.* per Cent. per Annum?

Answer, 626*l.* 13*s.*

What present Money will discharge 10000*l.* due at 5 D.ys, Rebate being made at 8*l.* per Cent. per Annum?

Answer, 9989*l.* 1*s.* 5*d.* $\frac{3}{4}$



Now, The Time of Payment, if not so given, must be reduced into one Name.



Let 100 be the sum, then find in what Time to come the sum of these present Words will be increased to the Total of all the particular payments, and that is the true Time for the Payment of the Whole.

CHAP. VII.

EQUATION of PAYMENTS.

THE Design of this Rule is, when several Sums are due at several Times, to find a mean Time for paying the whole Debt.

The common Way to do which is,

Multiply each Sum by its respective Time, and add all the Products together, dividing their Total by the whole Debt; the Quotient is the mean Time of paying the whole Debt.

Example.

A. owes to B. 40 l. to pay at 3 Months, 60 at 5 Months, and 100 l. at 10 Months; at what Time may the whole Debt be paid together, without Injury to either?

l.	l.	l.	l.
40	40	60	100
60	3	5	10
100	<u> </u>	<u> </u>	<u> </u>
	120	300	1000
<u>200</u>			300
			120
			<u> </u>

2|00)14|20(

Answer, 7 Months.

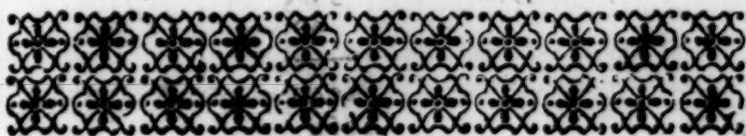
Note, The Times of Payment, if not so given, must be reduc'd into one Name.

But those who are more exact, take the Pains to work these Sums by the following Rule.

First they find the present Worth of every particular Sum, then find in what Time to come the Sum of these present Worths will be increas'd to the Total of all the particular Sums payable at the several Times to come, and that is the true equated Time for Payment of the Whole.



C H A P.



C H A P. VIII.

FELLOWSHIP, or COMPANY,

IS when two, or more, join their Stocks, and trade together, dividing their Gain, or Loss, proportionably.

Fellowship

Is either with or without Time.

Questions without Time, are work'd by this Proportion.

As the whole Stock to the whole Gain or Loss; so is each Man's particular Stock, to his particular Share.

Example.

A. B. and C. make a Joint-Stock, A. puts in 460*l.* B. 510*l.* and C. 480*l.* they gain 340*l.* what Part of it belongs to each?

	<i>l.</i>
A. —————	460
B. —————	510
C. —————	480
	—————
Total Stock	1450

Then,

Arithmetical

Then, if 145|0 ————— 340 ————— 46|0

46

2040

1360

145 15640 107

145

C H A. P. VIII.

1140

1015

125

20

FELLOWSHIP COMPANY

145 2500 17

145

1050

1015

35

12

145 420 2

290

130

4

145 520 3

435

85

80

80

Total Stock 1470

Then

If

Vulgar Arithmetick.

81

$$\begin{array}{r} \text{If } 145 \overset{l.}{\mid} 0 \quad \text{---} \quad 340 \overset{l.}{\mid} \quad \text{---} \quad 51 \overset{l.}{\mid} 0 \end{array}$$

51

340

1700

l.

$$145 \overline{) 17340} (119$$

145

284

145

1390

1305

85

20

s.

$$145 \overline{) 1700} (11$$

145

250

145

105

12

d.

$$145 \overline{) 1260} (8$$

1160

100

4

$$145 \overline{) 400} (2$$

290

110

And

And, if $\frac{1}{45} | 0$ — $\frac{1}{340}$ — $\frac{1}{48} | 0$

48

2720

1360

145)16320(112

145

182

145

370

290

80

20

145)1600(11

145

150

145

15

12

8)60(7+1

64

145)240(1

145

95

95

011

	l.	s.	d.	Remainders.
A's Share is	107	17	2 $\frac{3}{4}$	85
B's Share is	119	11	8 $\frac{1}{2}$	110
C's Share is	112	11	0 $\frac{1}{4}$	95
				145)290(2

The whole Gain 340 00 0—

290

And thus are these Sums provid.

More Examples.

Three Persons make a Joint-Stock; A. puts in 565 l. B. 278 l. and C. 629 l. they gain 1000 l. what is each of their Shares?

	l.	s.	d.	Remainders.
Answer, { A.	188	16	7 $\frac{1}{4}$	384
B.	188	17	2—	512
C.	427	66	2 $\frac{1}{4}$	576

D. E. and F. trade together; D. puts in 130 l. E. 529 l. and F. 344 l. 10 s. their whole Gain amounts to 520 l. what is that to each?

	l.	s.	d.	Remainders.
Answer, { D.	108	7	7 $\frac{3}{4}$	271
E.	249	5	7—	844
F.	162	6	9—	1092

A. B. and C. make a Bank of 3256 l. whereof A. puts in 1026 l. B. 985 l. and C. the rest; by Misfortune they lose 2000 l. what Part of it must each bear?

	l.	s.	d.	Remainders.
Answer, { A.	630	4	5—	928
B.	605	0	8 $\frac{3}{4}$	1240
C.	764	14	10—	1088

Fellowship with Time,

I S. thus work'd: Multiply each Man's Stock by the respective Time he puts it in for, and add all the Products, the Total of which must be your first Number through all the Statings; the Gain, or Loss, the second (as before); and each Man's particular Stock multiply'd by its Time, the third.

Note, All the particular Times (if not so given) must be reduc'd into one Name, (i. e.) all Years, all Months, all Weeks, or all Days, &c.

Example.

A. put into Company 560*l.* for 8 Months, B. 279*l.* for 10 Months, and C. 735*l.* for 6 Months; they gain'd 1000*l.* what Share of it must each have?

<i>l.</i>	<i>l.</i>	<i>l.</i>
560	279	735
8	10	6
<u>A. —</u>	<u>B. —</u>	<u>C. —</u>
4480	2790	4410
	2790	4480
		<u>11680</u>

Then

l. l. l.

Then, if 1168|0, ——— 1000 ——— 448|0 0.8011 11

0001 1000

8000, 0000, 0000, 0000
0000

1168)448000(383
3504

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•9760

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9344

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•4160

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3504

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•656

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1168)13120(11
8011

1168)13120(11
1168

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•1440

0000

1168

0000

•272

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12

1168)3164(2
5704

1168)3164(2
2336

0000

•928

00

4

1168)3712(3
4072

1168)3712(3
3504

0000

•208

0000

If 1168|0

1000

79|0

1000

1168)20384(17

1168)279000(238

7072

2336

4072

4540

7168

3504

1016

10360

1016

9344

016

1016

01

20

1168)20320(17

1168)20320(17

7072

1168

4072

8640

7168

8176

1016

464

01

12

1168)5568(4

1168)5568(4

4672

4672

016

896

01

4

1168)3584(3

1168)3584(3

4072

3504

016

80

Algebra Arithmetick.

87

And if $1168 \mid 0$ 1000 $441 \mid 0$

1000

$1168 \mid 441000(377$
 208
 3594
 880
 8176
 8176

1000 00 0—

The whole Gain.

1168

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CHAP.

I 2

More

More Examples.

*A. B. and C. agreeing to trade together, A. puts in 529*l.* for 4 Months; B. 329*l.* for 7 Months; and C. 900*l.* for 2 Months; by their Trade they gain 540*l.* what Part of it belongs to each?*

	<i>l.</i>	<i>s.</i>	<i>d.</i>		<i>Remainders.</i>
<i>Answer,</i> { <i>A.</i>	183	14	8	—	2304
{ <i>B.</i>	199	19	5	—	1332
{ <i>C.</i>	156	05	10 $\frac{1}{4}$	—	2583

Three Persons make a Joint-Stock; *A.* puts in 400 Pieces of Holland, each containing 96 Yards, at 5*s.* 6*d.* per Ell *Flemish*, for 5 Months; *B.* 600 Guineas for 8 Months; and *C.* 1800*l.* for 4 Months; but at 3 Months End, takes out 800*l.* they gain in all 1000*l.* how much is each of their Shares?

	<i>l.</i>	<i>s.</i>	<i>d.</i>		<i>Remainders.</i>
<i>Answer,</i> { <i>A.</i>	858	19	1 $\frac{1}{4}$	—	2988
{ <i>B.</i>	62	19	1 $\frac{3}{4}$	—	1956
{ <i>C.</i>	78	01	8 $\frac{1}{4}$	—	3252



First, Place the Quantities and their Values below



Sum of all the Simples

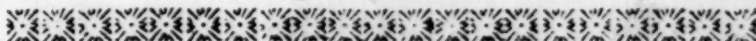
C H A P. IX.

Then, if it consists of 1 or 2 Simples

ALLIGATION

IS the compounding many Simples into one Mass, according to any requir'd Price, or Proportion.

This Rule is usually divided into two Parts, distinguish'd by the Names of *Medial* and *Alternate*.



For a Grocer would mix 18 lb of Currants at 5 d.

Alligation Medial

A Answers such Questions as having the Quantities and Prices of the several Simples given, only demand the mean Rate of any particular Part of the Composition.

Rule.

As the Sum of all the Simples,

To their total Value :

So is any Quantity of the Mixture,

To the Price thereof.

Examples.

(1st.) A Grocer would mix 18 lb of Currants at 5 d. per lb, and 29 lb at 6 d. per lb, with 12 lb at 8 d per lb, at what Rate may he sell a Pound of the Mixture?

I 3

First,

First, place the Quantities and their Values as below.

lb	d.	s. d.
18 at 5 per lb comes to		7 6
29 at 6 —————		to 14 6
12 at 8 —————		to 8 0
		—

Sum of all the Sim. 59

l. 1 10 0 Total Value.

lb

l. s.

lb

Then, if 59 comes to 1 10 what will 1

20

30

12

— d.

59)360(6 Answer.

354

..6

Ex. 2. A Grocer would with 12 C. of Sugar, at 3 l. per C. mix 3 C. at 50s. per C. and 8 C. at 45s. per C. What will 5 C. of this Mixture be worth?

The Quantities and their Values, plac'd as before, will stand thus:

C.

l. s.

12 at 3 l. p. C. is 36 00

3 at 50s. p. C. is 7 10

8 at 45s. p. C. is 18 00

Sum of the Simples 23

61 10 Tot. Value.

Examples.

(1) A Grocer would mix 12 lb of Quantities as 2 l. and 3 lb at 6d. per lb. What will 5 lb of this Mixture be worth? Then,

Then, if $23 \overset{C.}{\text{---}} \overset{l. s.}{\text{---}} \overset{C.}{\text{---}}$

20

1230

5

23)6150(267

46

131. 71. 4d. $\frac{1}{2}$ farit

155

138

170

161

9

12

23)108(4

92

16

4

23)64(2

46

18

The Proof of this, is as in the *Rule of Three*, only by reverſing the Proportion.

So the firſt Example may be prov'd by this back Stating.

It $\overset{d.}{\text{---}} \overset{It}{\text{---}}$
If 1 $\overset{6}{\text{---}} \overset{59}{\text{---}}$

And the laſt by this,

C. $\overset{l. s. d.}{\text{---}} \overset{C.}{\text{---}}$

If 5 $\overset{13}{\text{---}} \overset{7}{\text{---}} \overset{4}{\text{---}} \overset{\frac{1}{2}}{\text{---}} \overset{23}{\text{---}}$

remembering in both to take in the Remainders.

More Examples.

If a Vintner mingleth 12 Gallons of Canary, at 6s. 8d. per Gallon, with 20 Gallons of White Wine, at 5s. per Gallon, and 10 Gallons of Cyder, at 3s. per Gallon; at what Rate must he sell a Quart of the Mixture?

Answer, 1s. 3d.

If with 40 Bushels of Corn, at 4s. per Bushel, there is mix'd 10 Bushels at 6s. per Bushel, 30 Bushels at 5s. per Bushel, and 20 Bushels at 3s. per Bushel; what will 10 Bushels of the Mixture be worth?

Answer, 2l. 3s.



Alligation Alternate,

Teacheth what Quantities of several Simples (whose Values are given) must be mix'd, that the Composition may bear a Price propounded.

This Sort of *Alligation* has three Varieties.

Variety I.

When the Price of each Simple is express'd, but no Quantity given, and it is requir'd how much of each Simple must be mix'd, to sell any Part of the Composition at a mean Price propounded.

In this Variety you have only to link the several Extreames rightly together, and to find the true Differences betwixt them and the Mean; for those Differences are the Quantities sought.

Example.

A Vintner would mix four Sorts of Wine of 12d. of 18d. of 24d. and of 26d. per Quart, what Quantity of each must he take, to sell the Mixture at 20d per Quart?

To

To place your Numbers, and link the Extreame, observe these

Rules.

1st. Set down the several given Prices (which must always be of one Name) in a Column, one under another; then, towards your left Hand, draw a Line of Connection; and on the other Side of the said Line, place the mean Rate.

Thus then will stand the Numbers of the given

Example.

$\left. \begin{array}{l} 12 \\ 18 \\ 24 \\ 26 \end{array} \right\} 20$	12
	18
	24
	26

2^d. Link them two and two together, always observing to join a Greater and a Less than the Mean; and against each Extreame place the Difference betwixt the Mean and its Yoke-Fellow:

Thus,

$\left. \begin{array}{l} 12 \\ 18 \\ 24 \\ 26 \end{array} \right\} 20$	12	4
	18	6
	24	8
	26	2

Thus the Difference betwixt the Extreame 12, and 20 the Mean, being 8, is plac'd against 24 its Yoke-Fellow; and between 18 and 20 being 2, is plac'd against 26: So also the Difference betwixt 24 and 20 being 4, is plac'd against 12; and 6, the Difference betwixt 26 and 20, is set against 18.

So that if he mixes 4 Quarts at 12 d. 6 at 18 d. 8 at 24 d. and 2 at 26 d. per Quart, he may sell the Mixture at 20 d. per Quart.

The Proof of which is easy. For the Sum of the Differences valu'd at the mean Rate, will be found equal to the Amount of the particular Differences at their given Prices.

For

For 20 Quarts, the Sum of the Differences at 20 d. per Quart, is 400 Pence; and 4. 6. 8. 2 Quarts, the particular Differences, at 12, 18, 24, 26 Pence per Quart, will come to the same Sum.

But note, as many different Ways as the Extreame may be combin'd, so many different Answers may be given to the Question, yet all true.

So the same Example being combin'd

thus: thus:

$$20 \left\{ \begin{array}{l} 12 \\ 18 \\ 24 \\ 26 \end{array} \right\} \begin{array}{l} 6 \\ 4 \\ 2 \\ 8 \end{array} \left. \vphantom{\begin{array}{l} 12 \\ 18 \\ 24 \\ 26 \end{array}} \right\} \text{Answer.}$$

$$20 \left\{ \begin{array}{l} 12 \\ 18 \\ 24 \\ 26 \end{array} \right\} \begin{array}{l} 4.6 \\ 4.6 \\ 8.2 \\ 8.2 \end{array} \left. \vphantom{\begin{array}{l} 12 \\ 18 \\ 24 \\ 26 \end{array}} \right\} \begin{array}{l} 10 \\ 10 \\ 10 \\ 10 \end{array} \left. \vphantom{\begin{array}{l} 10 \\ 10 \\ 10 \\ 10 \end{array}} \right\} \text{Answer.}$$

gives those different, but true Answers, as may be prov'd by the same Rule.

In the last of these Examples the Numbers being doubly combin'd, (i. e.) each with two others, make each have two Differences set against it; for 12 the first Extreame, being link'd both with 24 and 26, must have both their Differences, viz. 4 and 6, plac'd against it; and so the rest. Which double Difference must be added, and plac'd as above.

But when in a Question there is but one Extreame less, or but one greater than the Mean; such a Question will admit but of one Answer; that single Extreame being to be link'd with all the rest.

Example.

A Grocer would mix Sugars, at 5 d. 6 d. and 10 d. per lb. so as to sell the Compound at 8 d. per lb; what Quantity of each must he take?

$$8 \left\{ \begin{array}{l} 5 \\ 6 \\ 10 \end{array} \right\} \begin{array}{l} 2 \\ 2 \\ 3.2 \end{array} \left. \vphantom{\begin{array}{l} 5 \\ 6 \\ 10 \end{array}} \right\} \begin{array}{l} 2 \\ 2 \\ 5 \end{array}$$

The Proof of which is easy, for the Sum of the Differences valu'd at the mean Rate, will be found equal to the Amount of the particular Differences at the given Prices.

The

The Numbers being plac'd, link'd, and differenc'd, (as above) according to the foregoing Rules, it appears that to sell his Sugar at 8 *d.* per lb, he must mix 2 lb at 5 *d.* 2 lb at 6 *d.* and 5 lb at 10 *d.* per lb.

More Examples.

A Tobacconist would mix Tobacco of 2 *s.* 1 *s.* 6 *d.* and 1 *s.* 3 *d.* per lb, so as to sell the Compound at 1 *s.* 8 *d.* per lb, what Quantity of each must he take?

lb s. d.

Answer, $\left\{ \begin{array}{l} 7 \text{ at } 2 \text{ } 0 \\ 4 \text{ at } 1 \text{ } 6 \\ 4 \text{ at } 1 \text{ } 3 \end{array} \right\} \text{ per lb}$

Several Sorts of Tea, viz. of 13 *s.* 18 *s.* 26 *s.* and 30 *s.* per lb, are to be so mix'd, that the Compound may be worth 22 *s.* per lb, what Quantity of each must there be?

lb s.

Answer, $\left\{ \begin{array}{l} 8 \text{ at } 13 \\ 4 \text{ at } 18 \\ 4 \text{ at } 26 \\ 9 \text{ at } 30 \end{array} \right\} \text{ per lb}$

Variety 2.

Here we have the Price of all the Simples, and the Quantity of one given, to find the several Quantities of the rest: So that one Measure, or Quantity, may be sold at a mean Rate propounded.

When the Numbers have been set down, and their several Differences found by the foregoing Rules, you must proceed by this Proportion.

As the Difference of that Number whose Quantity is given,

To the rest of the Differences one after another:

So the Quantity given,

To the several Quantities sought.

Example.

Example.

A Distiller would with 40 Gallons of *French Brandy*, at 12 s. per Gallon, mix *English Brandy* at 7 s. per Gallon, and Spirits at 4 s. per Gallon; how much of the two last Sorts must he add, to sell the whole at 8 s. per Gallon?

$$8 \left\{ \begin{array}{l} 12 \\ 7 \\ 4 \end{array} \right. \begin{array}{l} 1.4 \\ 4 \\ 4 \end{array} \begin{array}{l} 5 \\ 4 \\ 4 \end{array}$$

Now it is plain, that were there but 5 Gallons of the *French Brandy*, there must also be but 4 Gallons of each of the other Liquors; but since there is to be 40 Gallons of the *French Brandy*, say,

As 5 the Difference against its Price,

To 4 the Difference against the Price of the *English Brandy*,

So is 40 the given Quantity of *French*,

To the Quantity of *English* sought,

which, by this Proportion will be found to be 32. Then again,

As the first Difference 5,

To 4, the Difference against the Price of the Spirits:

So 40, the said given Quantity,

To the Quantity of Spirits sought.

Which, because their Differences are alike, will be the same as of the *English Brandy*, viz. 32.

This Variety has the same Proof as the former.

More Examples.

How much Tea at 14 s. per lb, and of 18 s. per lb, must be mix'd with 8 lb at 24 s. per lb, so as to allow the lb at 20 s?

Answer, 8 l. of each Sort.

I would with 21 lb of Snuff, at 8 s. per lb, mix so much of 4 s. per lb, and so much of 5 s. per lb, that I might

might afford to sell the Mixture at 6s. per lb, what Quantity of each must I take?

Answer, $\left\{ \begin{array}{l} 21 \text{ at } 8 \\ 14 \text{ at } 4 \\ 14 \text{ at } 5 \end{array} \right\} \text{ per lb}$

Variety 3.

In this Variety, the particular Prices of each Simple being given, as also the mean Rate of the Compound, is it requir'd how much of each Sort must be taken, to make up the Quantity propounded?

Which (after the Work of the first Variety) is perform'd by this Proportion:

As the Sum of the Differences
To the total Quantity:
So each particular Difference
To its particular Quantity.

Example.

A Druggist hath four Sorts of Green Tea, at 5s. 6s. 8s. and 9s. per lb, and would make up a Quantity of 87 lb to sell at 7s. per lb, how much of each must he take?

See the Work.

	lb	s.		lb	lb	lb
7 {	5	2-29	at 5 per lb	If 6	87	2
	6	1-14	$\frac{1}{2}$ at 6 per lb		2	
	8	1-14	$\frac{1}{2}$ at 8 per lb		lb	
	9	2-29	at 9 per lb	6)	174	(29
	6				0	

	lb	lb	lb
If 6	87	1	
	1		
	lb		
6)	87	(14	$\frac{1}{2}$
	3		

K

More

More Examples.

A Vintner hath three Sorts of Wine, of 6s. 8s. and 10s. per Gallon, of all which he would compose a Quantity of 120 Gallons, to sell at 7s. per Gallon, what Quantity must there be of each?

	Gall.	s.	
Answer,	{	80 at	6
		20 at	8
		20 at	10
			} per Gallon.

A Grocer having Sugars of 5d. 6d. 8d. 10d. and 11d. per lb, would make a Mixture of 3 C. wt. to sell at 7d. per lb, how much of each must he take?

	lb	d.	
Answer,	{	140 at	5
		84 at	6
		28 at	8
		28 at	10
		56 at	11
			} per lb



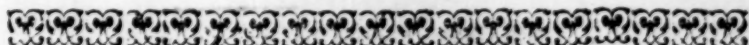


C H A P. X.

The Rule of FALSE, or
P O S I T I O N,

IS not so call'd because it is really erroneous, but only because that by the Help of false suppos'd Numbers, we find the Truth.

This Rule is usually divided into two Parts, *Single*, and *Double*.



Single Position.

IN this Part we make but one Supposition, with which working as with a true Number, we regulate the Result by this Proportion, *viz.*

As the Total arising from the Error,
To the true Total:
So the suppos'd Part,
To the true One.

Examples.

1st. *A. B. and C. designing to buy a Quantity of Lead, to the Value of 140*l.* agree that B. shall pay as much again as A. and C. as much again as B. what then must each pay?*

Now, supposing *A.* to pay 10*l.* then *B.* must pay 20*l.* and *C.* 40*l.* the Total of which is 70*l.* but should be 140*l.* therefore,

If 70*l.* should be 140*l.* what should 10*l.* be
l.

Answer 20 for *A*'s Share,
 which doubled, makes 40 for *B*'s Share,
 and that again doubled, gives 80 for *C*'s Share.

The Total of which is 140 as it should be.

2^d. Suppose the Sum of 20*l.* were to be paid by *A. B. and C.* thus, *A.* $\frac{1}{2}$, *B.* $\frac{1}{3}$, *C.* $\frac{1}{4}$, what must each pay according to that Proportion?

	<i>l.</i>	<i>l.</i>	<i>s. d.</i>
First, the $\frac{1}{2}$ of 20 being	10	0	0
the $\frac{1}{3}$ —————	6	13	4
and the $\frac{1}{4}$ —————	5	0	0

The Total will be 21 13 4
 but should have been but 20*l.* therefore the Parts found must be thus regulated:

<i>l.</i>	<i>s. d.</i>	<i>l.</i>	<i>s. d.</i>	<i>l.</i>	<i>s. d.</i>
If 21	13 4	fall to 20,	$\left\{ \begin{array}{l} 10 \ 0 \ 0 \\ 6 \ 13 \ 4 \\ 5 \ 0 \ 0 \end{array} \right\}$	Answer,	$\left\{ \begin{array}{l} 9 \ 4 \ 7 \ \frac{1}{4} \\ 6 \ 3 \ 0 \ \frac{3}{4} \\ 4 \ 12 \ 3 \ \frac{1}{2} \end{array} \right\}$
what will	—————				—————

which, with the Addition of $\frac{1}{2}$ makes just 20 0 0—

found by dividing the total $\left\{ \begin{array}{l} 28 \\ 36 \\ 40 \end{array} \right\}$
 of the Remainders, ———

by the common Divisor 52)104(2

0

More

More Examples.

A Gentleman bought a Chaise, Horse, and Harness for 50*l.* the Horse came to twice the Price of the Harness, and the Chaise to twice as much as both Horse and Harness, what did he give for each?

	<i>l.</i>	<i>s.</i>	<i>d.</i>	Remainders.
<i>Answer,</i> { the Harness	5	11	1 $\frac{1}{4}$	15
the Horse	11	2	2 $\frac{1}{2}$	30
the Chaise	33	6	8	

A. B. and *C.* disputing of their Age, *A.* affirms he is as old as *B.* and $\frac{1}{2}$ as old as *C.* and *B.* says, that he is $\frac{3}{4}$ as old as *C.* upon which *C.* says, he is sure both their Ages, added to his, will make 110 Years. I demand the Age of each?

$$\text{Answer, } \begin{cases} A. 45 \frac{1}{2} \\ B. 27 \frac{3}{4} \\ C. 36 \frac{1}{2} \end{cases}$$



Double Position.

IN this Part two Suppositions are requir'd, which (if both prove false) are, with their Errors, to be thus dispos'd.

Set down both your Suppositions, and against each of them their respective Errors, mark'd thus +, if too much; or thus —, if too little.

Then multiplying them cross ways, that is, the first Supposition by the second Error, and the second Supposition by the first Error; if both the Errors are alike, (i. e.) both too little, or both too much, subtract the lesser Product from the greater, and divide the Remainder by the Difference of the Errors. But if the Errors are unlike, i. e. one too little, and the other too much, the Sum of these Products must be divided

by the Sum of the Errors: The Quotient will give the true Number, exactly answering all the Demands of the Question.

Or the Suppositions and their Errors, being plac'd as before, work by this Proportion, as a general Rule, viz.

As the Difference of the Errors, if alike,

Or their Sum, if unlike,

To the Difference of the Suppositions:

So either Error to a fourth Number,

which accordingly added to, or subtracted from, the Supposition against it, will answer the Question.

Examples.

1st. *A. B. and C. playing at Cards, the Money stak'd was 324 Crowns; but disagreeing, each seiz'd as many as he could; A. got a certain Number, B. as many as A. and 15 over; C. got a fifth Part of both their Sums added together, how many had each?*

First, suppose *A. got 50*

then *B's Share will be 65*

and *C's* ———— *23*

All which added, make but 138 which is 186 too few.

Then, supposing again that *A. got 80*

B's Share will be 95

And *C's* ———— *35*

The Total of which is still but 210, too few by 114.

Therefore, setting down the Suppositions, and their Errors (mark'd as before directed) against them, they will stand thus:

Suppositions. Errors.

50 ———— 186

80 ———— 114

then

then multiply'd cross-ways, the Products will be 14880, and 57000; the lesser of which (the Errors being alike, *i. e.* both too little) being taken from the greater, there will remain 9180 for a Dividend, which divided by 72, the Difference of the two Errors, quotes $127 \frac{1}{2}$, the true Number of Crowns *A.* took up; as will appear, by adding 15 to them for *B.*'s Share, and dividing the Sum of *A.*'s and *B.*'s for *C.*'s Share; for so their particular Numbers will be found to be as follows:

$$\begin{array}{rcl} A's & \text{---} & 127 \frac{1}{2} \\ B's & \text{---} & 142 \frac{1}{2} \\ C's & \text{---} & 54 \end{array}$$

The Total of which is 324, the Numb. of Crowns given,

Or by the other Rule,

As 72, the Difference of the Errors, (because alike) to 30, the Difference of the Suppositions:

So is $\left\{ \begin{array}{c} 186 \\ \text{or} \\ 114 \end{array} \right\}$ to $\left\{ \begin{array}{c} 77 \frac{1}{2} \\ \text{added} \\ 47 \frac{1}{2} \end{array} \right\}$ to $\left\{ \begin{array}{c} 50 \\ \text{or} \\ 80 \end{array} \right\}$ gives $127 \frac{1}{2}$ as before.

Example 2.

When first the Marriage-Knot was ty'd

Betwixt my Wife and me;

My Age did hers as far exceed,

As three times three does three.

But after ten and half ten Years,

We Man and Wife had been;

Her Age came up as near to mine,

As eight is to sixteen.

————— Now, pray,
What were our Ages on our Wedding-Day?

First,

First, suppose her 21 then he must be 63
then adding to each 15 ————— 15

her Age becomes 36 his 78

This Error therefore is 3 Years too few.

But supposing her 9, the Error will prove 3 too many.

Setting down therefore against the Suppositions, the Errors, with their respective Marks, they will stand thus:

Suppositions. Errors.

21	—	3
9	+	3

Then multiplying cross-ways, 3 times 21 is 63
and 3 times 9 is 27

These Products (because unlike) added, make 90 for a Dividend, which divided by 6, the Sum of the Errors quores 15, her true Age, prov'd thus:

She being 15, he must be ——— 45
15 Years added to each 15

Makes hers 30, just half of his — 60

Or, by the other Rule,

As 6, the Sum of the Errors, (because unlike) to 12, the Difference of the Suppositions :

So is the common Error, 3 to 6, which either subtracted from 21, or added to 9, gives 15 (as before) for her Age.

More Examples.

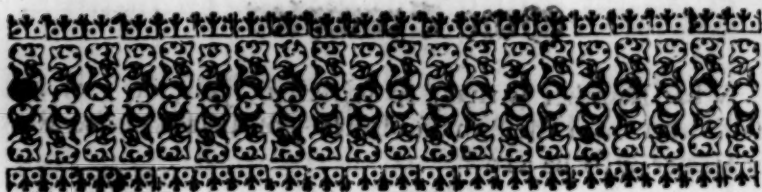
What Number is that, to which if you add $\frac{1}{4}$ of itself, and from the Sum subtract $\frac{1}{3}$ of its self, the Remainder will be 210 ?

Answer, 192

A Gentleman caught a Fish, whose Head was 6 Inches long, the Tail as long as the Head, and half as long as the Body, the Body was just the Length of Head and Tail, I demand the Length of the Fish ?

Answer, 48 Inches, or 4 Feet.





C H A P. XI.

E X C H A N G E

IS the receiving Money in one Country, for the Value paid in another.

Note.

The Par of Exchange is certain and fix'd, being always *par pro pari*, like for like, according to the Weight and Fineness of the Coin.

But the Course, or current running Price, betwixt any two Countries, rises and falls upon every Occasion.

It would be both needless and endless to write of every Kind of Exchange; we shall therefore only give Examples of the Exchanges of *England*, with some other chief Countries of *Europe*, And first with

France.

At *Paris*, *Lyons*, *Rouen*, &c. they keep their Accompts in Livres, Solzs, and Deniers; and Exchange upon the Crown, the Par of which in Sterling Money, is 4s. 6d.

C H A P.

Note.

Note.

$$\left. \begin{array}{l} 12 \text{ Deniers} \\ 20 \text{ Solz} \\ 3 \text{ Livres} \end{array} \right\} \text{make} \left\{ \begin{array}{l} 1 \text{ Solz} \\ 1 \text{ Livre} \\ 1 \text{ Crown} \end{array} \right.$$

French Money is chang'd into Sterling by this Proportion.

As 1 Crown to the given Rate:

So is the given French Sum to the Sterling sought.

Or,

By supposing the given French Crowns, Goods, and the Rate of Exchange, the Price; so casting up their Value by Practice.

Examples.

1st. What Sterling Money must be paid in London, to receive in Paris 438 Crowns; Exchange at 56 d. per Crown?

$$\begin{array}{r} \text{Cr.} \quad \text{d.} \quad \text{Cr.} \\ \text{If } 1 \text{ --- } 56 \text{ --- } 438 \\ \quad \quad \quad 56 \end{array}$$

$$\begin{array}{r} 2628 \\ 2190 \\ \hline \end{array}$$

12)24528(

2|0)20414

102 l. 4 s.

$$\begin{array}{r} \text{Cr.} \quad \text{d.} \quad \text{s. d.} \\ 438 \text{ at } 56 \text{ or } 4:8 \text{ per Cr.} \end{array}$$

$$\begin{array}{r} 4s. \frac{1}{5} \quad 87 \quad 12 \\ 6d. \frac{1}{8} \quad 10 \quad 19 \\ 2d. \frac{1}{3} \quad 3 \quad 13 \end{array}$$

102 4

2d. Change 537 Crowns, 14 Solz, 10 Deniers, into Sterling Money, Exchange at 52 d. $\frac{1}{2}$ per Crown.

Cr. d.	Cr. Solz. De.	Cr. Solz. De. d.
If 1—52 $\frac{1}{2}$	537 14 10	537 14 10 at 52 $\frac{1}{2}$
60 2	60	
12		4s. $\frac{1}{5}$ 107 8
—105	32234	4d. $\frac{1}{12}$ 8 19
720	12	$\frac{1}{2}$ $\frac{1}{8}$ 1 2 4 $\frac{1}{2}$
		Solz. 10 $\frac{1}{5}$ 8 $\frac{1}{4}$
	386818	2 $\frac{1}{5}$ 1 $\frac{3}{4}$
	105	2 $\frac{1}{5}$ 1 $\frac{3}{4}$
		Deniers 10 $\frac{1}{12}$ of 10 Solz. $\frac{1}{2}$
	1934090	
	3868180	117l. 10s. 5d. $\frac{1}{2}$

72|0)4061589|0(56410

360

12)28205(5

461

432

2|0)235|0

295

288

117l. 10s. 5d. $\frac{1}{4}$ facit.

78

72

69

2

72)138(1

72

66

Sterling Money is chang'd into *French* by this Proportion :

As the Rate of Exchange, to one Crown :

So is the given *English* Sum, to the *French* sought.

For Examples,

Take the Reverse of the former Questions; which will also be their Proof.

1st. How many *French* Crowns must be paid in *Paris*, to receive in *London* 102 l. 4 s. Sterling? Exchange at 56 d. per Crown.

d.	Cr.	l.	s.
If 56 — 1 — 102 4			
			20
		20	44
			12
		Crowns.	
		56	24528(438
			224
			212
			168
			448
			448
			0

L

2d. Change

Ex. 2d. Change 117 l. 10 s. 3 d. $\frac{1}{4}$ Sterling, into French Crowns. Exchange at 52 d. $\frac{1}{2}$ per Crown.

If 52 $\frac{1}{2}$ ——— 1 ——— 117 10 5 $\frac{1}{4}$

4
—

210 ——— 2350

12

28205

4

51

60

—— Solz.

21 | 0 306 | 0 (14

21

96

84

12

12

66 the Remainder of the other Sum.

21 | 210 | 10 Deniers.

21

00

More Examples.

If I pay in Paris 8297 Crowns, 13 Solz, 08 Den. what may draw my Bill for to London, when the Exchange is at 54 d. $\frac{1}{4}$ per Crown?

Answer, 1875 l. 10 s. 4 d. $\frac{1}{4}$

What Sterling Money is equal to 954 Crowns, 52 Solz, when the Exchange is at 58 d. $\frac{1}{8}$ per Crown?

Answer, 231 l. 5 s. 1 d. $\frac{1}{2}$

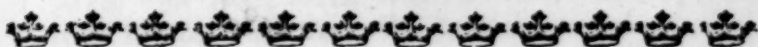
If

If I pay in London 536*l.* what French Money shall I receive in Paris, Exchange at 57*d.* per Crown?

Answer, 2256 Crowns, 5 Solz.

What French Money is equal to 1529*l.* 10*s.* Exchange at 53*d.* per Crown?

Answer, 6393 Crowns, 31 Solz, 3 Deniers.



Secondly, with ITALY.

IN Genoa, Leghorn, &c. they keep their Accompts in Livres, Solz, and Deniers; and Exchange upon the Piece of Eight, or Dollar; the *Par* of which with London, is also 4*s.* 6*d.* Sterling.

Note.

At Genoa 5 Livres make a Piece of Eight, at Leghorn 6. Observe the Rules for exchanging with France.

Examples.

How much Sterling shall I receive in London, if I pay in Genoa 820 Dollars? Exchange at 51*d.* per Dollar, or Piece of Eight.

Dollar. *d.* Dollars. Dollars.
If 1 ——— 51 ——— 820 820 at 51*d.* per Dollar.

$$\begin{array}{r}
 820 \\
 \times 51 \\
 \hline
 8200 \\
 4100 \\
 \hline
 41820
 \end{array}
 \quad
 \begin{array}{r}
 820 \text{ at } 51 \text{ d. per Dollar.} \\
 820 \times 51 \\
 820 \times 50 = 41000 \\
 820 \times 1 = 820 \\
 \hline
 41820
 \end{array}$$

L 2

Or

Or, back again,

If in *London* I pay 174*l.* 5*s.* Sterling, how many Dollars shall I receive in *Genoa*? Exchange at 51*d.* per Dollar.

d.	Dollar.	l.	s.
If 51	----- 1	-----	174 5

20

3485

12

51)41820(820

408

102

102

...0

Venice exchanges by the Duccat, the Par about 56*d.* $\frac{1}{4}$ Sterling.

Example.

Change 512 Duccats into Sterling-Money, Exchange 55*d.* $\frac{1}{2}$ per Duccat.

Duc.	d.	Duc.
If 1	----- 55 $\frac{1}{2}$	----- 512

2

512

Duccats. d. (tion.

512 at 55 $\frac{1}{2}$ per Duc.

111

2)56832(

d.

4

2048

12)28416(

6 $\frac{1}{2}$

256

1 $\frac{1}{2}$ $\frac{1}{4}$

64

2)0)236|8

2368

118*l.* 8*s.*

118*l.* 8*s.*

Thirdly,

Thirdly, with SPAIN.

IN Madrid, Sevil, &c. they keep their Accompts in Rials and Mervadies, and Exchange also by the Piece of Eight. The Par with London 4 s. 6 d.

Note.

372 Mervadies } make { 1 Rial.
8 Rials } { 1 Piece of 8.

This Exchange is also cast up by the foregoing Rules.

Example.

What Sterling Money may I draw for to London, if I pay in Sevil 4798 Rials, 250 Mervadies? Exchange at 58 d. Sterling per Piece of 8.

4798 Rials
250 Mervadies

4823 Rials

8046 Rials

1156 Rials

5888 Rials

3744 Rials

Rials. d. Rials. Mer.
If 8—58—4798 250

372

372

2976

9596

33591

14596

1785106

58

14280848

8925530

12

2576)103536148(34790(2

8928

210)28919(

14256

11904

144 19 2 $\frac{1}{4}$

23521

20832

26894

26784

11108

4

2976)4432(1

2976

1456

Change

Or, back again,

Change 144 l. 19 s. 2 d. $\frac{1}{4}$ Sterling into Spanish Money. Exchange at 58 d. per Piece of $\frac{8}{1}$

d.	Rials.	l.	s.	d.
If 58	— 8 —	144	19	2 $\frac{1}{4}$

4		20
---	--	----

232		2899
-----	--	------

12

34790

4

139161

8

232) 1113288 (4798 Rials.

928

1852

1624

2288

2008

2008

1856

152

372

304

1064

456

1456 Rem. of the other.

232) 58000 (250 Mervadies.

464

1160

1160

... 0

More

More Examples.

Change 83927 Rials into Pounds Sterling, Exchange at 54 d. $\frac{1}{2}$ per Piece of Eight.

Answer 2382 l. 6 s. 0 d. $\frac{1}{2}$.

If I pay in London 5000 l. what Spanish Money may I draw my Bill for to Madrid? Exchange at 57 d. $\frac{1}{8}$ per Piece of Eight.

Answer 168052 Rials, 192 Mervadies.



Fourthly, with PORTUGAL.

IN Lisbon, Oporto, &c. they keep their Accompts in Rees, and Exchange on the Mill-Ree; the Par of which is about 6 s. 8 d. $\frac{1}{2}$ Sterling.

Note.

1000 Rees make 1 Mill-Ree.

To make this Exchange, still observe the same Rule.

Examples.

Change 48009 Rees into Sterling Money, Exchange at 6 s. 5 d. per Mill Ree.

M. R.	s. d.	Rees.
If 1	6 5	48009
1000	12	77

1000 12 77

336063
336063

12
1000)36961693(36961

4
2103018

21772 15 l. 8 s. 0 d. $\frac{1}{2}$

Change

Or, back again,

Change 15 l. 8 s. 0 d. $\frac{1}{4}$ Sterling into Rees, Exchange at 6 s. 5 d. per Mill-Ree.

	Rees.	l. s.
If 6 s. 5 d. ——— 1000 ———		15 8 0 $\frac{1}{4}$
12		20
—		—
77		30
4		12
—		—
308		3696
		4
		—
		14786
		1000

Note 772, Rem. of the other Stating, is here taken in.

	Rees.
308) 14786772 (43009	
	1232
	—
	2466
	2464
	—
	2772
	2772
	—
	...0

More Examples.

What Sterling Money is equal to 595677 Rees Exchange, at 6 s. 7 d. per Mill-Ree?

Answer, 196 l. 1 s. 6 d.

Change 59 l. 12 s. into Rees, Exchange at 6 s. 10 d. $\frac{1}{4}$ per Mill-Ree?

Answer, 173381 Rees,

Fifthly,

Fifthly, with HOLLAND, FLANDERS and GERMANY.

I Take these Places together, because their Accompts are kept, and their Exchange with *England* made the same Way.

For not only in *Amsterdam*, but also in *Antwerp* and *Hamborough*, they keep their Accompts in Pounds, Shillings, and Pence *Flemish*; or, Guilders, Stivers, and Pennicks; and exchange with us upon our Pound, giving us for it, when at *Par*, 33 s. 4 d. *Flemish*.

Note.

Their Pounds, Shillings, and Pence, are divided as ours, viz. their Pound into 20 Shillings, and their Shilling into 12 Pence

Their other Money is thus divided.

16 Pennicks } make { 1 Stiver.
20 Stivers } make { 1 Guilder.

Note also,

6 Stivers } make { 1 Shilling { *Flemish*.
6 Guilders } make { 1 Pound {

Sterling Money is exchange'd into *Flemish* by this Proportion, viz.

As 1 l. Sterling to the given Rate;

So is the given Sterling to the *Flemish* sought.

Or,

By supposing the given Sterling, Goods, and the given Rate, their Price, casting up their Value by Practice.

Example.

Example.

If I pay in *London* 492*l.* Sterling, what may I draw my Bill for to *Amsterdam*? Exchange at 34*s.* 5*d.* *Flem.* per *l.* Sterling.

	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>
If I	492	34	5	
		12		492
				413

Or by Practice.	413	1476
<i>lb.</i>	<i>s.</i>	<i>d.</i>
	492	1968

492 at 34 5 per <i>l.</i>	1968
10 $\frac{1}{2}$ 246	
4 $\frac{1}{4}$ 98 8	12) 203196(
d. 4 $\frac{1}{2}$ 8 4	
I $\frac{1}{4}$ 2 1	210(169313(

486*l.* 13*s.* *facit.*

846*l.* 13*s.* *Flem.*

If you would have the Answer in Guilders and Stivers,

Divide the *Flemish* Pence by 40, (the Number of Pence which make a Guilder) and the Quotient will be Guilders; and if any Thing remains, the half of it will be Stivers, two *Flemish* Pence being one Stiver.

Or,

Multiply the *Flemish* Pounds, Shillings, and Pence by 6, and it will produce Guilders and Stivers; for 6 Guilders make 1 Pound *Flemish*, and 6 Stivers 1 Shilling *Flemish*.

Example.

846*l.* 13*s.* the *Facit* of the last Sum.
6

5079 G. 18 S.	<i>Flemish</i> Pence.
	410)2031916(36 rem.

5079 Guild. 18 Stivers.

Flemish

Flemish Money (whether Pounds, Shillings, &c. or Guilders, Stivers, and Pennicks) is exchange'd into Sterling thus.

As the given Rate to 1 Pound Sterling, so is the given *Flemish* to the Sterling sought.

Examples.

Change 846 l. 13 s. *Flemish* into Sterling Money,
Exchange at 34 s. 5 d. *Flemish* per l. Sterling.

s.	d.	Flem.	l.	Ster.	l.	s.	Flem.
If 34	5	—	1	—	846	13	
	12	—				20	

413

16933

12

413)203196(492 l. Sterling.
1652

3799

3717

. . 826

826

. . 0

Or,

Change 5079 Guilders, 18 Stivers into Sterling-Money, Exchange 34 s. 5 d. per l. Sterling.

Example.

5079	34
18	5
—	—
—	—

If

121

If $34 \frac{5}{12} - 1 = 5079 \frac{18}{20}$

413

101598

2

413)203196(492 l. Sterling.

1652

• 3799

3717

. . 826

826

Q

More Examples.

Change 475 l. Sterling, into *Flemish* Money, Exchange at 33 s. *Flemish* per l. Sterling.

Answer, 783 l. 15 s. Flemish.

What *Flemish Money* is equal to 365 *l.* 12 *s.* Exchange at 36 *s.* 5 *d.* per *l.* Sterling.

Answer, 665 l. 13 s. 11 d. Flem.

If I pay at *Amsterdam* 5389 l. 14 s. *Flemish*, what Sterling Money shall I receive at *London*, Exchange at 32 s. 8 d. *Flemish* per l. Sterling?

Answer, 3299 l. 16s. 3 d. $\frac{3}{4}$ Flemish.

Change 572 l. 13 s. Sterling into Guilders, Stivers,
 &c. Exchange at 34 s. 10 d. *Flemish* per l. Sterling.

Answer, 5984 Guilders, 3 Stivers, 12 Pen.

What may I draw my Bill for to *London*, if I pay in

M

Antwerp

Antwerp 7256 Guilders, Exchange at 35 s. 2 d. $\frac{1}{2}$ per l. Sterling.

Answer, 686 l. 19 s. 2 d. Sterling.



An Explanation of some Characters sometimes us'd for Brevity's Sake.

+ IS the Mark of *Addition*, and shews the Numbers it's plac'd between, are to be added together.

— Is the Mark of *Subtraction*, and shews the latter of the Numbers it stands between, is to be taken from the former.

X is the Mark of *Multiplication*, and shews the Numbers on each Side, are to be multiply'd together.

÷ Is the Mark of *Division*, and plac'd between two Numbers, shews the first is to be divided by the last.

= Is the Mark of *Equality*, and shews the Number or Numbers preceding it, are equal to that which follows it.

√ Plac'd before any Figures, shews the Square-Root of them is meant. And

√c Before a Number, denotes its Cube-Root.

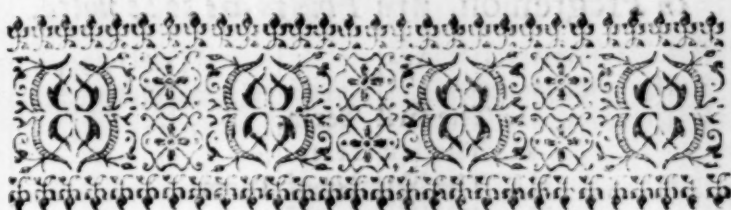
To make all more plain, observe,

Thus the Characters are us'd :

$$\sqrt{c} 4096 = 16, \sqrt{16} = 4, 4 + 2 = 6, 6 - 2 = 4, 4 \times 2 = 8, 8 \div 2 = 4.$$

And thus read :

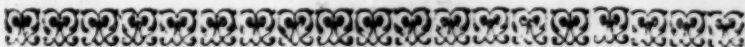
The Cube-Root of 4096 is, or is equal to, 16; the Square-Root of 16, is equal to 4; 4 added to, or more by 2, is equal to 6; and 6, made less by 2, is equal to 4; again, 4, multiply'd by 2, is equal to 8; and 8, divided by 2, is equal to 4.



C H A P. XII.

PROGRESSION

BEING a Rule more curious than useful, and requiring more Words for its full Explication, than are consistent with this *Compendium*, I shall only give some (the most necessary) Propositions in both its Parts, Arithmetical and Geometrical; and refer the more inquisitive Reader to Mr. Oughtred's *Clavis Mathematicæ*, or Mr. Hill's late ingenious *Treatise of Arithmetick*.



Arithmetical Progression,

IS the regular Increase or Decrease of any Rank of Numbers, by the continual Addition or Subtraction of some equal Number.

So 1, 4, 7, 10, 13, 16, are in Arithmetical Progression to each other, equally increasing by the continual Addition of 3.

And so also are 84, 82, 80, 78, regularly decreasing by the continual Subtraction of 2.

In Progression, five Things are to be noted.

Viz.

- I. The first Term.
- II. The last Term.
- III. The Number of Terms.
- IV. The equal Difference.
- V. The Sum of all the Terms.

Any three of which being given, the other two may be found; but it would be too tedious to treat of all the Varieties this will admit; the most useful are as follows.

Proposition I.

The last Term, Number of Terms, and equal Difference, being given to find the first Term :

Or the second, third, and fourth given, to find the first.

Rule.

Multiply the fourth by the third, made less by one, and subtract the Product from the second, the Remainder is the Answer.

Example.

A Man takes out of his Pocket, at 6 several Times, 6 several Numbers of Shillings, every one exceeding the former by 6, the last was 42, what was the first?
Answer, 12 s.

$$6 \times 5 = 30, 42 - 30 = 12 \text{ Answer.}$$

Proposition II.

The first, third, and fourth given, to find the second.

Rule.

Rule.

From the Product of the fourth, multiply'd by the third, subtract the fourth, the Remainder added to the first, gives the second.

Example.

What's the last Number of an Arithmetical Progression, beginning at 4, and continuing, by the Increase of 12 to 18 Places? *Answer, 208.*

$$12 \times 18 = 216, 216 - 12 = 204, 204 + 4 = 208 \text{ Answer.}$$

Proposition III.

The first, second, and fourth given, to find the third.

Rule.

Subtract the first from the second, and divide the Remainder by the fourth, the Quotient, with one added, gives the third.

Example.

A Traveller went 12 Miles the first Day; and increas'd every Day's Journey by 4 Miles, 'till at last he went 64 Miles in one Day; how many Days did he travel? *Answer, 14 Days.*

$$64 - 12 = 52, 52 \div 4 = 13, 13 + 1 = 14 \text{ Answer.}$$

Proposition IV.

The first, second, and third given, to find the fourth.

Rule.

Subtract the first from the second, and divide the Remainder by the third, made less by one, the Quotient gives the fourth.

Example.

The Ages of seven Children increase by Arithmetick Progression; the youngest is 2 Years-old, the eldest 32, what's the common Difference of their Ages? *Answer* 5 Years.

$$32 - 2 = 30, 30 \div 7 - 1 = 5 \text{ Answer.}$$

Proposition V.

The first, second, and third given, to find the fifth.

Rule.

Half the Sum of the first and second, multiply'd by the third, produces the fifth.

Example.

12 Persons give their Charity to a poor Man in Arithmetical Progression; the first gave 2 Pence, the last 2 Shillings, or 24 Pence; how much did the poor Man get? *Answer*, 156 Pence, or 13 Shillings.

$$2 + 24 = 26, 26 \div 2 = 13, 13 \times 12 = 156 \text{ Answer.}$$

Geometrical.



Geometrical Progression,

IS the increasing or decreasing of any Rank of Numbers by some equal *Ratio*, that is, by the continual Multiplication or Division of some equal Number.

Thus 2, 4, 8, 16, 32, increase in Geometrical Progression by a double *Ratio*, or continual Multiplication by 2, and 405, 135, 45, 15, 5, decrease after the same Manner by a continual Division by 3, or by a triple *Ratio*.

In Geometrical Progression, the same five Things are to be noted as in Arithmetical Progression.

Viz.

- I. The first Term.
- II. The last Term.
- III. The Number of Terms.
- IV. The *Ratio*, or equal Difference.
- V. The Sum of all the Terms.

Note, It is sometimes necessary to set over the Terms their Exponents, the more readily to discover their Places.

Thus	0	1	2	3	4	5
	2	4	8	16	32	64

Proposition I.

To find any remote Term of a Geometrical Progression proceeding from Unity, whose *Ratio* or common Difference is known, without producing all the intermediate Terms.

Rules.

Rule.

Find some few of the leading Terms, and place over them their Exponents; then multiplying the last found Term by its self, it will produce a Term double thereto; which again multiply'd by its self, will produce another double to the last: Thus proceed, 'till either you produce the Term sought, or one a little short of it; which may be compleated by multiplying it again by that Term, which stands under such Exponent as would make up the Number.

Or in other Words, observe what Figures of the Exponents found added together, would give the Exponent of the Term wanted, and the Numbers standing under the said Exponents, multiply'd into each other, will produce the Term requir'd.

Example.

One agrees for 14 Oranges, to pay only the Price of the last at a Farthing for the first, an half Penny the second, &c. still doubling the Price for the next, what must he give?

Here setting down only the five first Terms, with their Exponents, the fourteenth may thus be found, $5 \times 5 \times 4 = 14$. So the Terms under those Exponents being multiply'd into each other, give the Term answering. But as the Exponent 1 stands always over the second Term, so the Exponent 13 answers to the 14th Term; therefore add only 3 to the two 5's; and so always that Exponent must be taken, which is one short of the Term requir'd, as for 20, 19, for 30, 29, &c. which must be carefully noted.

See the Work of the foregoing Example.

Exponents.

$$\begin{array}{r} 5 \\ 5 \\ 3 \\ \hline 13 \end{array}$$

Terms.

$$\begin{array}{r} 32 \text{ the 5th multiply'd} \\ 32 \text{ by its self.} \\ \hline 64 \\ 96 \end{array}$$

gives 1024 the 10th, which
multiply'd by 8 the 3d Term,

gives 8192 the 14th.

And so many Farthings, or 8 *l.* 10 *s.* 8 *d.* must he give at the Rate agreed.

Proposition II.

To find any remote Term of a Geometrical Progression, not proceeding from Unity, whose *Ratio* and first Term is given, without producing all the intermediate Terms.

Rule.

Set down, as before, some few of the leading Terms, with their Exponents, and multiply also, as in the first Proposition, the Terms under such Exponents, as added would make the Exponent short by one of the Term requir'd; only remember that every Product must here be divided by the first Term.

Example.

A Sum of Money is thus to be divided among 9 Persons, the 1st to have 50 *l.* the 2d 150 *l.* and so on in that Proportion, one three times more than the other, to the last; what will the last have?

Setting

Setting down the five first Terms with their Exponents, thus,

$$\begin{array}{cccccc} 0 & 1 & 2 & 3 & 4 \\ 50 & 150 & 450 & 1350 & 4050 \end{array}$$

Multiply the last Term by its self, and divide the Product by 50, the first Term the Quotient will be 328050 the 9th Term requir'd, answering to the 8th Exponent.

Or setting down but the three first Terms, multiply the last by its self, and divide the Product by the 1st Term, it quotes the 5th; which again multiply'd by its self, and divided by the 1st, will quote the 9th, as before. See the Work.

$$\begin{array}{r} \begin{array}{ccc} 0 & 1 & 2 \\ 50 & 150 & 450 \end{array} & \begin{array}{r} 450 \\ 450 \\ \hline 22500 \\ 1800 \\ \hline 510)2025010(\\ \hline 4050 \end{array} & \begin{array}{r} 4050 \\ 4050 \\ \hline 202500 \\ 162000 \\ \hline 510)164025010(\\ \hline 3 \end{array} \end{array}$$

Answer, 328050 l. for the 9th Person.

Proposition III.

Having the first Term, the common Excess, and the Number of Places given, to find the total Sum of the whole Progression.

Rule.

Having found the last Term by the foregoing Rules, subtract from it the first, and divide the Remainder by the common Excess, made less by one, the Quotient is the Sum of all, except the last, to which, that being also added, gives the Total requir'd.

Note.

Note. If the *Ratio* be double, that is, if the common Excess be 2, the Difference between the least and greatest Term added to the greatest, gives the total Sum. If the *Ratio* be triple, $\frac{1}{2}$ the Difference must be added; if quadruple, $\frac{1}{3}$, &c.

Examples.

1st. A Coffee-Man, upon the signing of the last Peace, for 50 Guineas down, agreed to pay the first Day one Coffee-Berry, the second two, the third four, and so on, to double the Quantity every Day, 'till the same was proclaim'd. What Number of Berries would it amount to, supposing the Time 60 Days. And what would their Value be, supposing 1000 Berries to the Pound, and the lb to be sold at 5 s.

See the Work.

Days.

Days. Berries.

1	—	1	16
2	—	2	16
3	—	4	96
4	—	8	16
5	—	16	256

2

512 the 10th Day.

16

3072

512

8192

2

16384 the 15th Day.

16384

65536

131072

49152

98304

16384

268435456

2

536870912 the 30th Day.

536870912

1073741824

536870912

4831838208

37580963840

4294967296

3221225472

1610612736

2684354560

288230376151711744

2

376460752303423488 the 60th Day.

1000(7529215046068461975 total Number of Berries.

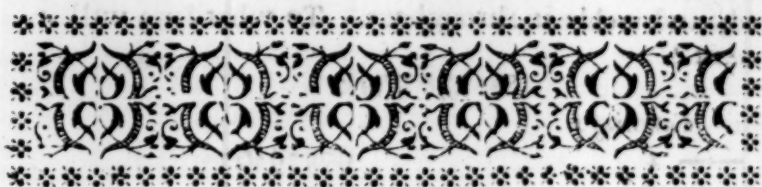
5s. $\frac{1}{4}$ 188230376151711 l. 10s. their Value at 5s. per lb

Ex. 2. A Grazier offers 40 Oxen for a Farthing a Head, and treble it throughout. To what Sum will it amount?

See the Work.

Oxen. Farthings.

1	—	1	99379467
2	—	3	99379467
3	—	9	
4	—	27	695656269
5	—	81	596276802
		81	397517868
	—		894415203
	81		695656269
	648		298138401
	—		894415203
	6561		894415203
	3		
	—		9876278461204089
19683	10th Ox.		3
19683			
	—		29628835383612267 the 40th Ox.
59049			
157464			44443253075418400 Tot. Farth.
118098			Or,
19683			462950552868941. 3s. 4d.
	—		
33126489			
	3		
	—		
99379467	the 20th Ox.		



CHAP. XIII.

VULGAR FRACTIONS.

A Fraction is a Part, or Parts, of an Unit, and written (if Vulgar) with two Figures, with a Line drawn between them, as $\frac{1}{2}$, $\frac{2}{3}$, or $\frac{6}{7}$.

The Figure under the Line is call'd the Denominator, because it shews into what Parts the Unit is broken; and that above, the Numerator, because it tells how many of such Parts are meant by the Fraction. Thus the Fraction $\frac{1}{3}$ shews, that the Unit is divided into 3 Parts, and that 1 of those Parts are thereby express'd.

Of Vulgar Fractions, there are four Sorts, viz.

1st. A *Proper*; whose Numerator is always less than its Denominator, as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, &c.

2^d. An *Improper*; whose Numerator is always equal, or greater than its Denominator, as $\frac{5}{3}$, $\frac{6}{2}$, &c.

3^d. A *Compound*, or, *Fraction of a Fraction*; known by the Word *of*, as $\frac{3}{4}$ of $\frac{5}{6}$, &c.

4th. A *Mix'd Fraction*; which is a Fraction join'd with a whole Number, as $5 \frac{1}{2}$, $3 \frac{2}{3}$, &c.

Before Fractions can be either added or subtracted, they must be reduc'd into one Denomination; and therefore, before we proceed to those Rules, we must learn

Reduction

Reduction of FRACTIONS,

IN which there are seven Varieties.
First, To reduce a whole Number into an *Improper Fraction*, which is done by placing 1 for its Denominator.

Examples.

Reduce 4 to a Fraction, *facit* $\frac{4}{1}$
 or 18, ——— *facit* $\frac{18}{1}$

But if you would assign it any other Denominator, multiply the whole Number by the Denominator assign'd, and place the Product for a Numerator over the assign'd Denominator.

Examples.

Reduce 12 to a Fraction, whose Denominator let be 8.
 $\frac{8}{8}$ *facit* $\frac{24}{8}$

Or if 6 were to be made a Fraction, and its Denominator to be 7, it would become $\frac{42}{7}$.

Second, To reduce a mix'd Fraction into an improper one,

Multiply the whole Number by the Denominator of the Fraction given, and take in the Numerator; the Product place for a new Numerator over the Denominator given.

Examples.

Reduce $5 \frac{1}{3}$ to an improper Fraction. *facit* $\frac{16}{3}$

3

—

16

3

So $12\frac{1}{2}$, reduc'd to an improper Fraction, will be $\frac{25}{2}$.

Third, To reduce an improper Fraction into its equivalent whole, or mix'd Number.

Rule.

Divide the Numerator by the Denominator, the Quotient gives the whole Number contain'd: But if any thing remains, (as in the 2d Example) it must be plac'd as a new Numerator over the given Denominator.

Examples.

Reduce $\frac{32}{8}$ to its equivalent whole Number.

$$\begin{array}{r} 8 \overline{)32} 4 \text{ facit} \\ \underline{} \\ 0 \end{array}$$

Reduce $\frac{45}{6}$ to its equivalent whole Number.

$$\begin{array}{r} 6 \overline{)45} 7 \frac{3}{2} \text{ facit.} \\ \underline{} \\ 3 \end{array}$$

Fourth, To reduce a Compound Fraction to a single one.

Rule.

Multiply all the Numerators together for a Numerator, and all the Denominators for a Denominator.

Examples.

Examples.

Reduce $\frac{4}{6}$ of $\frac{6}{7}$ of $\frac{7}{8}$ to a single Fraction.

$$\begin{array}{r} 4 \\ 6 \\ \hline 24 \\ 7 \\ \hline 168 \end{array}$$

$$\begin{array}{r} 5 \\ 8 \\ \hline 40 \\ 9 \\ \hline 360 \end{array}$$

$\frac{168}{360}$ facit.

So also $\frac{1}{8}$ of $\frac{2}{3}$ is $\frac{17}{80}$.

Fifth, To reduce a Fraction into its lowest Terms.

Rule.

Divide the Numerator and Denominator by any Figure, so that nothing may remain, and the Quotients will be a new Fraction of the same Value with that given.

The Rule generally given for finding the greatest common Measure, or Number, to divide your given Fraction by, is this,

Divide the Denominator by the Numerator, and the Numerator by the Remainder, if any. So continuing to make the last Divisor the Dividend, and the Remainder the Divisor, 'till nothing remains, the last Divisor will be the greatest common Measure, or Number, by which you can divide your Fraction.

Example.

What is the greatest common Measure by which $\frac{308}{674}$ can be divided?

$$208)684(3$$

$$624$$

$$\hline$$

$$60)208(3$$

$$180$$

$$\hline$$

$$28)60(2$$

$$56$$

$$\hline$$

$$\text{Answer } 4)28(7$$

$$28$$

$$\hline$$

$$0$$

$\frac{308}{674}$ then being divided by 4, gives $\frac{77}{168}$, which are its lowest Terms.

But this Way of finding the common Measure, is too tedious, often making more Work than it saves. Observe therefore these more practical Directions.

If you cannot at once discover the greatest Number you may divide by, if both your Numerator and Denominator are even Numbers, you may always halve them, and often that Way reduce your Fraction to Advantage.

Thus the Fraction given in the foregoing Example, divided twice by 2, gives, as before, $\frac{77}{168}$.

$$2 \frac{308}{674} | \frac{154}{337} | \frac{77}{168}$$

and $\frac{77}{168}$ may be reduc'd, by continual halving, to $\frac{7}{24}$,

$$2 \frac{77}{168} | \frac{77}{84} | \frac{77}{42} | \frac{77}{21} | \frac{77}{10.5} | \frac{77}{5.25}$$

Also, when both your Numerator and Denominator have Cyphers on the right Hand, you may abbreviate the Fraction,

Fraction, by striking off an equal Number from both ;

thus, $\frac{45}{90} | \frac{00}{00}$ or, $\frac{825}{900} | \frac{00}{00}$

Or, if the right Hand Figures of your Numerator and Denominator, are both Fives, or one a Five and the other a Cypher, (as the Remainder of the last Example) you may always divide them by 5 ;

thus, $\frac{825}{900}$, divided by 5

is $\frac{165}{180}$, equal to $\frac{11}{12}$.

So also is $\frac{125}{300}$ reduc'd to $\frac{5}{12}$.

Thus, in the Rule of Three, we abbreviate our Statings by the same Rule, and on the same Reason ; for the second and third Numbers multiply'd together, are as a Numerator to the first Number, their Denominator.

Sixth, To reduce Fractions of divers Denominations, into one of the same Value.

Rule.

Multiply each of the given Numerators into all the given Denominators, except its own, and the several Products will be so many Numbers, whose common Denominator must be the Product of all the given Denominators multiply'd together.

Examples.

Reduce $\frac{3}{4}$, $\frac{5}{8}$, and $\frac{6}{10}$ into one Denomination.

To do which,

First, The Numerator 3, must be multiply'd by the Denominators 8 and 10; which will produce 140.

Secondly, The Numerator 5, multiply'd by the Denominators 4 and 10, will produce 200. } New Numerators.

Thirdly, The Numerator 6, multiply'd by the Denominators 4 and 8, will produce 192.

Then the three Denominators 4, 8, and 10, multiply'd together, will give 320 for a common Denominator.

See the Work.

$\begin{array}{r} 3 \\ 8 \\ \hline 24 \\ 10 \\ \hline 240 \end{array}$	$\begin{array}{r} 5 \\ 4 \\ \hline 20 \\ 10 \\ \hline 200 \end{array}$	$\begin{array}{r} 6 \\ 4 \\ \hline 24 \\ 8 \\ \hline 192 \end{array}$	$\begin{array}{r} 4 \\ 8 \\ \hline 32 \\ 10 \\ \hline 320 \end{array}$
1st Numer.	2d Numer.	3d Numer.	Denominator.

So $\frac{3}{10}$, $\frac{5}{12}$, and $\frac{6}{15}$, reduc'd into one Denomination, will be $\frac{360}{14400}$, $\frac{500}{14400}$, $\frac{480}{14400}$.

See the Work.

5	3	4	9
8	10	10	10
40	30	40	90
12	12	8	8
480	360	320	720
15	15	15	12
2400	1800	1600	8640
480	360	320	
7200	5400	4800	
1st Numer.	2d Numer.	3d Numer.	4th Numer.

$$\begin{array}{r}
 10 \\
 8 \\
 \hline
 80 \\
 12 \\
 \hline
 960 \\
 15 \\
 \hline
 4800 \\
 960 \\
 \hline
 14400 \\
 \text{Denominator.}
 \end{array}$$

Seventh. To value a Fraction, or reduce it to the known Parts of an Integer.

Rule.

Rule.

Multiply the Numerator by the next inferior Denomination, and divide the Product by the Denominator; the Quotient shews the Parts sought, and the Remainder becomes a new Numerator to the given Denominator; which must still be valu'd by the same Rule, proceeding 'till you have brought it into the least known Parts of the Integer.

Examples.

What's the Value of $\frac{13}{49}$ of a Pound Sterling?

$$\begin{array}{r}
 13 \\
 20 \\
 \hline
 \text{s. d.} \\
 49) 260 (5 \ 3 \frac{1}{2} \ \frac{34}{49} \text{ facit} \\
 245 \\
 \hline
 15 \\
 12 \\
 \hline
 49) 180 (3 \\
 147 \\
 \hline
 33 \\
 4 \\
 \hline
 49) 132 (2 \\
 98 \\
 \hline
 34
 \end{array}$$

And by this Rule are Remainders of Statings in the Rule of Three, &c. valu'd. See Pag. 23.

For another Example, find what Hundreds, Quarters, and Pounds, are contain'd in $\frac{53}{4}$ of a Ton.

$$\begin{array}{r} 53 \\ 20 \\ \hline \text{--- C. qrs. lb} \\ 94)1060(11 \text{ } 1 \text{ } 2 \frac{2}{4} \text{ facit.} \end{array}$$

$$\begin{array}{r} 94 \\ \hline 120 \\ 94 \\ \hline \end{array}$$

$$\begin{array}{r} 26 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \hline \end{array}$$

$$94)104(1$$

$$\begin{array}{r} 94 \\ \hline \end{array}$$

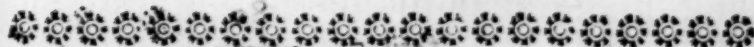
$$\begin{array}{r} 10 \\ \hline \end{array}$$

$$\begin{array}{r} 28 \\ \hline \end{array}$$

$$94)280(2$$

$$\begin{array}{r} 188 \\ \hline \end{array}$$

$$\begin{array}{r} 92 \\ \hline \end{array}$$



Addition of FRACTIONS.

WHEN the given Fractions are of one Denomination, all you have to do, is, to add their Numerators together, and to place the Sum for a new Numerator, over the Denominator given; thus, $\frac{1}{8}$, $\frac{2}{8}$, and $\frac{3}{8}$, added together, make $\frac{6}{8}$, or $1\frac{3}{4}$.

But when amongst the given Sums, there are either compound Fractions, or single ones of different Denominations,

minations, they must first be prepar'd by Reduction, before they can be added.

Examples.

What's the Sum of $\frac{3}{8}$, $\frac{2}{9}$, and $\frac{4}{7}$?

First, according to the 6th Sort of Reduction, the given Fractions being brought into one Denomination, they will be $\frac{189}{304}$, $\frac{112}{304}$, $\frac{176}{304}$; the Numerators of which being added, the Sum is $\frac{477}{304}$, or $1\frac{173}{304}$.

2d. Add $\frac{3}{4}$ of $\frac{3}{8}$, and $\frac{2}{10}$ of $\frac{6}{7}$ and $\frac{5}{8}$ together.

First, reduce the compound Fractions to single ones, by the 4th Rule of Reduction; and instead of $\frac{3}{4}$ of $\frac{3}{8}$, and $\frac{2}{10}$ of $\frac{6}{7}$, you will have $\frac{9}{32}$ and $\frac{12}{35}$, to add to your $\frac{5}{8}$; all which single Fractions being reduc'd, as before, to one Denomination, they will be $\frac{105}{1120}$, $\frac{384}{1120}$, and $\frac{1760}{1120}$; which, added, makes $\frac{3009}{1120}$, or $2\frac{1849}{1120}$.

3d. Add $4\frac{1}{2}$ and $3\frac{1}{8}$ and $\frac{3}{7}$ together.

$$\begin{array}{r}
 \frac{49}{84} \quad \frac{14}{84} \quad \frac{24}{84} \quad 4 \text{ --- } 42 \\
 \frac{14}{84} \quad \frac{14}{84} \quad \frac{24}{84} \quad 3 \text{ --- } 14 \\
 \hline
 \frac{14}{84} \quad \frac{14}{84} \quad \frac{24}{84} \quad 24 \\
 \hline
 \frac{14}{84} \quad \frac{14}{84} \quad \frac{24}{84} \quad 80 \\
 \text{facit } 7 \quad \text{---} \\
 \frac{14}{84} \quad \frac{14}{84} \quad \frac{24}{84} \quad 84
 \end{array}$$

More Examples.

Add 8 l. $\frac{1}{2}$ and 2 l. $\frac{2}{3}$ and $\frac{1}{12}$ together.

Facit 11 l. $\frac{13}{12}$.

What's the Sum of $\frac{3}{4}$ of $\frac{1}{7}$, and 4 l. $\frac{1}{2}$ and $\frac{1}{10}$?

Answer, 5 l. $\frac{10}{4}$.

Substraction

Subtraction of FRACTIONS,

IS also nothing (after the given Fractions are prepar'd by Reduction) but taking one Numerator from the other.

Examples.

$$1^{\text{st}}. \text{ From } \frac{3}{4} \text{ take } \frac{4}{9} \quad \begin{array}{r} 27 \\ 16 \end{array}$$

$$\text{prepar'd } \frac{27}{36} - \frac{16}{36} = \frac{11}{36} \text{ Remainder.}$$

$$2^{\text{d}}. \text{ From } 5 \frac{2}{3} \text{ take } \frac{9}{10}.$$

First, the mix'd Number $5 \frac{2}{3}$ being reduc'd to the improper Fraction $\frac{17}{3}$, by the 2d Rule of Reduction, proceed as before.

$$\text{From } \frac{17}{3} \text{ or } \frac{9}{10} \text{ take } \frac{9}{10} \text{ Rem. } \frac{143}{30} \text{ or } 4 \frac{23}{30}.$$

More Examples.

$$\begin{array}{ll} \text{From } 5 \frac{7}{8} \text{ take } \frac{9}{10} \text{ of } \frac{5}{6} & \text{Rem. } 5 \frac{1}{8} \\ \text{From } \frac{1}{2} \text{ take } \frac{1}{7} \text{ of } \frac{2}{3} & \text{Rem. } \frac{35}{42} \end{array}$$

Multiplication of FRACTIONS.

IF the Numbers given, are whole, or mix'd, they must first be brought into improper Fractions; or if they are compound Fractions, they must be reduc'd

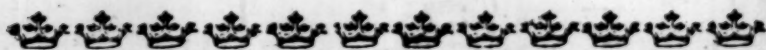
to single ones ; but if the Numbers given, are both either proper or improper single Fractions, you have only to multiply the two given Numerators together for a new Numerator, and the given Denominators for a Denominator.

Examples.

- 1st. Multiply $\frac{4}{8}$ by $\frac{3}{8}$ *facit* $\frac{12}{64}$, or, by Abreviation $\frac{3}{16}$
 2^d. Multiply $\frac{2}{8}$ by $\frac{4}{7}$ *facit* $\frac{8}{56}$ or $\frac{1}{7}$.
 3^d. Multiply 4 by $\frac{3}{8}$. 4 by the first Sort of Reduction, reduc'd to a Fraction, is $\frac{4}{1}$, which multiply'd by $\frac{3}{8}$, makes $\frac{12}{8}$, or $1\frac{1}{2}$.
 4th. Multiply $7\frac{1}{2}$ by $8\frac{2}{3}$. These mix'd Fractions, reduc'd by the 2^d Rule of Reduction to improper ones, make $\frac{15}{2}$ and $\frac{26}{3}$, which multiply'd together, make $\frac{390}{6}$, or 65.

More Examples.

- Multiply $9\frac{1}{2}$ by $\frac{2}{3}$, *facit* $3\frac{1}{3}$.
 Multiply 3 d. $\frac{3}{4}$ by 3 d. $\frac{3}{4}$, *facit* 14 d. $\frac{1}{8}$.



Division of FRACTIONS.

WHEN you have made the same Preparation of your Numbers as directed in Multiplication,

Multiply the Denominator of your Divisor by the Numerator of your Dividend, for a Numerator; and the Denominator of your Dividend, by the Numerator of your Divisor, for a Denominator.

Example.

- 1st. Divide $\frac{7}{8}$ by $\frac{3}{8}$, *facit* $\frac{56}{24}$, or $2\frac{2}{3}$.
 2^d. Divide 7 by $\frac{3}{4}$, prepar'd by the 1st Rule of Reduction, it will be $\frac{7}{1}$ by $\frac{3}{4}$, *facit* $\frac{28}{3}$, or $9\frac{1}{3}$.

3^d.

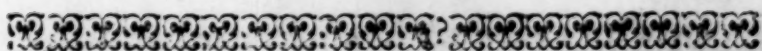
3d. Divide $4\frac{1}{2}$ by $2\frac{3}{8}$, reduc'd by the 2d Rule, it is $\frac{9}{2}$ by $\frac{19}{8}$, which, divided, gives $\frac{72}{19}$, or $1\frac{34}{19}$.

4th. Divide $\frac{2}{3}$ of $\frac{1}{2}$ by $\frac{4}{5}$ of $\frac{7}{8}$, reduc'd by the 4th Rule, $\frac{2}{3}$ by $\frac{38}{40}$, facit $\frac{138}{720}$.

More Examples.

Divide $\frac{7}{8}$ by $\frac{1}{3}$. Quote $2\frac{5}{8}$.

Divide $9\frac{1}{2}$ by $\frac{2}{3}$ of $\frac{3}{4}$. Quote $31\frac{3}{4}$.



The DIRECT RULE of THREE.

IN

VULGAR FRACTIONS.

AFTER the Numbers are prepar'd by Reduction, is both stated and work'd the same as in whole Numbers.

Examples.

1st. What will $\frac{1}{2}$ a Pound of Snuff cost, if 22 lb $\frac{3}{4}$ of the same comes to 7 l. $\frac{1}{3}$.

lb l. lb
If 22 $\frac{3}{4}$ cost 7 $\frac{1}{3}$, what will $\frac{1}{2}$?

Prepar'd by the 2d Rule of Reduction, it will stand thus,

If $\frac{82}{4} \dots \frac{22}{3} \dots \frac{1}{2}$

then the second and third Numbers multiply'd together, produce $\frac{22}{3}$; which divided by $\frac{82}{4}$, gives $\frac{88}{334}$; which, valu'd by the 7th Rule of Reduction, is 3 s.

3d. 29 s. $\frac{108}{334}$.

2d. Bought 87 Gallons and an $\frac{1}{2}$ of Brandy for 40 l . at the same Rate, what would $\frac{1}{2}$ a Gallon cost?

$$\begin{array}{rcccl} & \text{Gall.} & \text{l.} & \text{Gall.} & \\ \text{If } 87 \frac{1}{2} \text{ cost } 40, \text{ what will } \frac{1}{2} ? & & & & \\ \text{prepar'd } 17\frac{1}{2} & \text{---} & \frac{40}{1} & \text{---} & \frac{1}{2} \\ & & & & \text{l. s. d. qu.} \\ \text{then } \frac{40}{1} \times \frac{1}{2} = \frac{40}{2} = 20 \quad \text{or } 17\frac{1}{2} = \frac{80}{2} = \frac{80}{2} \text{ or } 40 \quad \text{or } 4 \text{ } 6 \text{ } 3 \frac{3}{4} \end{array}$$

Another Rule.

When your Question is stated, and your Numbers prepar'd, multiply the Denominator of the first Number by the Numerators of the second and third, and place the Product for a Numerator: Then multiply the Numerator of the first Number by the Denominators of the second and third, and place the Product for its Denominator; and the new Fraction so found, is the Answer of the Question. Take the Starting of the last Question for an

Example.

$$\text{If } 17\frac{1}{2} \dots 40 \frac{1}{1} \dots \frac{1}{2} \text{ facit } \frac{80}{2}$$

For 2, the Denominator of the first Number, multiply'd by 40 and 1, the Numerators of the second and third Numbers is 80.

And 175, the Numerator of the first, multiply'd by 1 and 2, the Denominators of the second and third is 350. These Products plac'd fractionally, make $\frac{80}{350}$, as before.

3d. What will 82 C. of Sugar come to, if $\frac{3}{4}$ of $\frac{1}{2}$ of a C. costs $\frac{9}{10}$ of a Pound Sterling.

$$\begin{array}{rcccl} & \text{C.} & \text{l.} & \text{C.} & \\ \text{If } \frac{3}{4} \text{ of } \frac{1}{2} \text{ costs } \frac{9}{10}, \text{ what will } 82 ? & & & & \end{array}$$

$$\begin{array}{rcccl} & \frac{9}{10} & \dots & \frac{9}{10} & \dots & \frac{82}{1} \\ \text{Facit } 233 \frac{1}{2} \text{ or } 259 \text{ } \frac{1}{2} \end{array}$$

$$262 \frac{2}{5}$$

More

More Examples.

What will $\frac{1}{4}$ of an Ounce of Snuff cost, if the lb comes to 8 s. $\frac{1}{2}$?

Answer, 1 d. $\frac{108}{192}$.

At 1 d. $\frac{1}{2}$ per Ounce, what will 5 C. $\frac{1}{2}$ come to?

Answer, 61 l. 12 s.



The Indirect RULE of THREE

I N

VULGAR FRACTIONS.

HERE also you have only to observe the Directions given in whole Numbers.

Or this Rule.

After the Numbers are stated and prepar'd, multiply the Numerators of the first and second Numbers, by the Denominator of the third, for a Numerator; and the Denominators of the first and second, by the Numerator of the third Number, for a Denominator; and the Fraction so found, is the *Answer*. See both Ways in the

Example.

How many Yards of Stuff, $\frac{1}{2}$ Yard wide, are equal to 36 Yards $\frac{1}{4}$ of $\frac{1}{4}$ wide.

If $\frac{1}{4}$ ——— 36 $\frac{1}{4}$ ——— $\frac{1}{2}$
 Prepar'd $\frac{1}{4}$. . . 145 . . . $\frac{1}{2}$
 0 3

Then . .

Then $\frac{3}{4} \times 145 = 43\frac{5}{8}$. $43\frac{5}{8} \div \frac{1}{2} = 87\frac{5}{8}$ or $54\frac{3}{4}$.

So also 3, 145, and 2, the Numerators of the first and second Numbers, and the Denominator of the third, multiply'd together, is 870.

And 4, 4, and 1, the Denominators of the first and second, and Numerator of the third, multiply'd together, produce 16.

These Numbers fractionally plac'd, make $87\frac{5}{8}$, as before.

More Examples.

If *A* lends *B* 25 $l.$ $\frac{1}{3}$ for 6 Months $\frac{1}{3}$, how long may he keep 100 $l.$ $\frac{1}{4}$ of *B*'s, to requite himself.

Answer, 16 Months $\frac{4}{5}$. $\frac{16}{248}$

If *A* keeps 100 $l.$ $\frac{1}{2}$ of *B*'s 4 Months $\frac{1}{3}$, what Sum must *A* lend *B* for 2 Years $\frac{1}{2}$ to requite him?

Answer, ~~24 Months $\frac{1}{3}$~~

$\pounds 130. \frac{26}{120}$



The End of the First Part.

ARITHMETICK IN EPITOME.

PART II.

CONTAINING
DECIMAL FRACTIONS,
AND

Extraction of the Roots.



Printed in the Year 1715.

ARITHMETICK

IN

EPITOME.

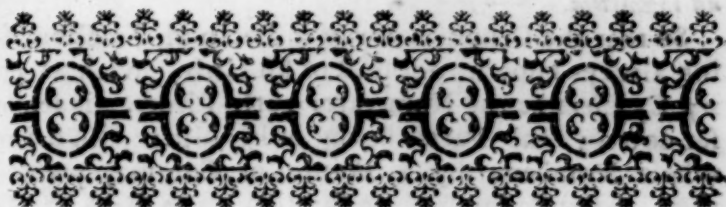
PART II.

CONTAINING
DECIMAL FRACTIONS,



Extracts from the Roots.

Printed in the Year 1715.



Decimal ARITHMETICK.

PART II.

CHAP. I.



THIS Part of Arithmetick is very compendious, and therefore very useful, especially in Calculations of Interest, valuing Annuities, &c. But by Reason some Fractions of Coin, Weight, and Measure, cannot be exactly express'd by Decimal Parts, but that the Numbers will often circulate, it is not always convenient to work with them. Mr. Cunn hath indeed, in his late Treatise on Fractions, very curiously shewn how they may be us'd with least Loss; but since such Exactness destroys their Brevity, I cannot but think, in such Cases, Vulgar Fractions preferable.

In Decimal Fractions, the *Integer*, or whole Thing, (whether it be Time, Coin, Weight, or Measure, as one Year, one Pound Sterling, one Pound Weight, &c.) is

is suppos'd to be divided into Tenths, or ten equal Parts; and those Parts again into Tenths, and so on *ad infinitum*.

So that the Denominator of a Decimal Fraction being always known to consist of an Unit, with as many Cyphers as the Numerator hath Places, is seldom set down; the Parts being only distinguish'd from whole Numbers, by a Point, or Comma, prefix'd; thus, .5 stands for $\frac{5}{10}$, .25 for $\frac{25}{100}$, .123 for $\frac{123}{1000}$, &c.

But the different Value of the several Places, will more plainly appear from the following

Table.

Whole Numb.	Decimal Parts.
1	Units.
2	Tens.
3	Hundreds.
4	Thousands.
5	Ten Thousands.
6	Hundred Thousands.
7	Millions.
8	Tens of Millions.
9	Hundreds of Millions.
0	Billions.

from whence it is evident,

1st. That as whole Numbers increase by a tenfold Proportion towards the left Hand, from the Unit's Place; so Decimal Parts decrease, in the same Proportion, towards the right.

2^d. That therefore Cyphers, plac'd before Decimal Parts, decrease their Value, by removing them farther from the Comma, or Unit's Place.

thus, $\begin{cases} 0,5, \text{ is } 5 \text{ Parts of Ten, or } \frac{5}{10}. \\ 0,05 \text{ is } 5 \text{ Parts of an Hundred, or } \frac{5}{100}. \\ 0,005 \text{ is } 5 \text{ Parts of a Thousand, or } \frac{5}{1000}. \end{cases}$ 3^d.

3d. But that Cyphers, after Decimal Parts, alter not their Value, because they do not change their Places.

for 0,5 0,50 0,500, &c. are each but $\frac{5}{10}$ of an Unit, or 1; the 5 still keeping its first Place.

These Things understood, the rest is easy.



Addition of DECIMALS.

HAVING set down your propos'd Numbers, Units under Units, Tens under Tens, and Parts under Parts of like Value, add them as if they were all whole Numbers, separating so many Decimal Parts in the Total, as were in any of the given Numbers.

Examples.

Add 5,42, and 38,583, and 421,06, and ,8345 together.

These Numbers,
rightly plac'd,
will stand thus:

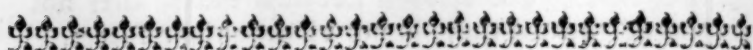
$$\begin{array}{r} 5,42 \\ 38,583 \\ 421,06 \\ ,8345 \\ \hline \end{array}$$

Total, 465,8975

What's the Sum of 4,06, and 21,734, and 523,8642

$$\begin{array}{r} 21,734 \\ 4,06 \\ \hline \end{array}$$

Answer, 549,65821.



SUBTRACTION.

HAVING plac'd the Numbers as directed in Addition, work still as if they were all whole Numbers.

Examples.

$$\begin{array}{r}
 \text{From } 839,38275 \text{ take } 10,49561 \\
 \underline{10,49561} \\
 828,88714 \text{ Remainder.}
 \end{array}$$

$$\begin{array}{r}
 \text{Take } 23,279 \text{ from } 451,15842 \\
 \underline{23,279} \\
 \text{Remains } 427,87942
 \end{array}$$



MULTIPLICATION.

HERE the Numbers are to be set down, (without Regard to the Value of their Places) and work'd in all Respects the same as in whole Numbers; only observe to separate so many Places of Decimal Parts on the right Hand of the Product, as were in both Multiplicand and Multiplier.

Examples.

Examples.

Multiply 2,735641 by ,54382

$$\begin{array}{r}
 2,735641 \\
 \times ,54382 \\
 \hline
 5471282 \\
 21885128 \\
 8206923 \\
 10942564 \\
 13678205 \\
 \hline
 1,48769628862
 \end{array}$$

Multiply 73,82564365
by 8,7434592

$$\begin{array}{r}
 73,82564365 \\
 \times 8,7434592 \\
 \hline
 14765128730 \\
 66443079285 \\
 36912821825 \\
 29530257460 \\
 22147693095 \\
 29530257460 \\
 51677950555 \\
 59060514920 \\
 \hline
 \end{array}$$

Product 645,491503167514080

A compendious Way to multiply Numbers that have many Decimal Places.

Rule.

Place one of the Numbers just as it is given for a Multiplicand, and under that Decimal Place which you would have be the last in the Product, set the Unit's Place of your other Number ; then reversing all the other Figures, multiply with them in their Order, beginning always with that Figure of the Multiplier, which stands over the Number you work with ; having also Respect to the Increase you think would have been brought from the omitted Figures on the right Hand, had they been multiply'd.

To prove the Certainty of the Rule, we will take the same

Examples.

Multiply 2,735641 by ,54382, and produce only four Places of Decimals.

$$\begin{array}{r}
 2,735641 \\
 28345,0 \\
 \hline
 13678 \\
 1094 \\
 82 \\
 22 \\
 \hline
 1,4876
 \end{array}$$

Note. There being no Units in the Multiplier, its Place is supply'd with a Cypher.

Multiply 73,82564365 by 8,7434592, and produce but three Places of Decimals.

$$\begin{array}{r}
 73,82564365 \\
 2954347,8 \\
 \hline
 590605 \\
 51678 \\
 2953 \\
 222 \\
 29 \\
 4 \\
 \hline
 645,491
 \end{array}$$

Note. To multiply any Decimal Number by 10, 100, 1000, &c. is only to remove the Mark of Separation so many Places towards the right Hand as there are Cyphers.

Thus

Thus 8,3564537, multiply'd by $\left\{ \begin{array}{l} 10, \\ 100, \\ 1000, \\ 10000, \end{array} \right\}$ is $\left\{ \begin{array}{l} 83,564537 \\ 835,64537 \\ 8356,4537 \\ 83564,537, \text{ \&c.} \end{array} \right.$



D I V I S I O N,

BEING also work'd the same as in whole Numbers, the only Difficulty is to value the Quotient; which may be done by either of the following general Rules, viz.

Rule 1.

The first Figure in the Quotient, is always of the same Value with that Figure of the Dividend which answers, or stands over the Place of Units in the Divisor: Or,

Rule 2.

The Quotient must always have so many Decimal Places, as the Dividend has more than the Divisor.

Note, 1st. If the Divisor and Dividend have both the same Number of Decimal Parts, (as in the second Example) the Quotient will be all a whole Number.

2^d. If the Dividend hath not so many Places of Decimals as are in the Divisor, (as in Example the 3^d) so many Cyphers must be annex'd to the Dividend, as will make them equal; and the Quotient will then, as before, be all whole Numbers.

3^d. But if when Division is done, the Quotient has not so many Figures as it should have Places of Decimal Parts, (as in the last Example) so many Cyphers must be prefix'd as there are Places wanting.

Examples.

1st. Divide 10,55439 by 4,569

$$4,569 \overline{) 10,55439} (2,31$$

$$\underline{14163}$$

$$\underline{4569}$$

...

Here, according to the first Rule, 4, the Unit's Place of the Divisor, standing under Units, or the first Place of whole Numbers in the Dividend; 2, the first Figure plac'd in the Quotient, must also be made the first Place of whole Numbers, by placing the Point of Separation immediately after it.

Or, according to the second Rule, there being five Places of Decimals in the Dividend, and but three in the Divisor; two Places must be separated off in the Quotient, to make up the Number.

Ex. 2^d. Divide 85643,825 by 6,321

$$6,321 \overline{) 85643,825} (13549$$

$$\underline{22433}$$

$$\underline{34708}$$

$$\underline{31032}$$

$$\underline{57485}$$

$$.596$$

Here 6, the Place of Units in the Divisor, standing under 8, the fifth Place of whole Numbers in the Dividend, 1, the first Figure of the Quotient, must also stand in the same Place, which makes all the Quotient whole Numbers.

And

And so it must also be by the second Rule, because the Dividend has no more Places of Decimals than the Divisor.

Ex. 3. Divide 7382,54 by 6,4352.

$$6,4352 \overline{) 7382,5400(1147}$$

Here there not being so many Places of Decimals in the Dividend, as in the Divisor, two Cyphers are added to make them even; and being so, the Quotient is all a whole Number, as before.

Ex. 4. Divide ,8516438 by 423

$$423 \overline{) ,8516438(,00020133}$$

$$\begin{array}{r} \text{..}564 \\ \hline \end{array}$$

$$\begin{array}{r} 1413 \\ \hline \end{array}$$

$$\begin{array}{r} \cdot 1448 \\ \hline \end{array}$$

$$\begin{array}{r} \cdot 179 \\ \hline \end{array}$$

In this Example, the Quotient consisting but of five Figures, whereas there should, by the Rules, be eight Places of decimal Parts, three Cyphers are prefix'd to make up the Number, as was directed in *Note* the third.

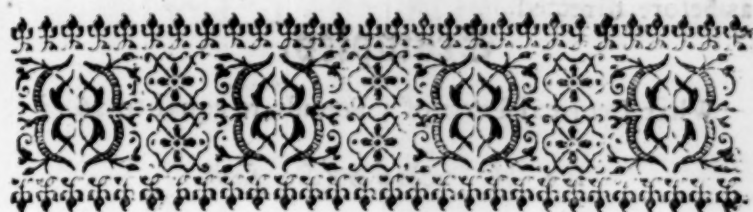
As multiplying by 10, 100, 1000, &c. is only removing the separating Point of the Multiplicand, so many Places as there are Cyphers in the Multiplier; so, to divide by 10, 100, 1000, &c. is only removing the Mark of Separation, after the same Manner, towards the left Hand.

$$\text{Thus } 83564,537 \left\{ \begin{array}{l} 10, \\ 100, \\ 1000, \\ 10000, \end{array} \right\} \text{ is } \left\{ \begin{array}{l} 8356,4537 \\ 835,64537 \\ 83,564537 \\ 8,3564537 \end{array} \right.$$

These Examples being, I hope, sufficient to make Division plain, we will now proceed to *Reduction of Denomials*.



CHAP.



CHAP. II.

Reduction of DECIMALS,

IS of two Sorts, 1st. To change a Vulgar Fraction to a Decimal. 2^d. To value a Decimal by the known Parts of an Integer.

1st. To reduce or change a Vulgar Fraction to a Decimal.

Rule.

Place Cyphers at Pleasure after the Numerator, and divide by the Denominator.

Examples.

Reduce $\frac{1}{4}$ to a Decimal 4)1,00(,25 *facit.*

What Decimal Parts are equal to $\frac{1}{8}$?

8)3,000(,375 *facit.*

And so any Part of Coin, Weight, Measure, or Time, &c. may be brought into a Decimal, by first reducing it into a Vulgar Fraction, (which is done by placing the known Parts of the Integer as a Denominator under the Parts given) then annexing Cyphers

to the Numerator, and dividing by the Denominator as before directed.

Examples.

What Decimal Parts of a Pound are equal to 16 s ?

$$i. e. \frac{1}{20} 20)16,00(,80 \text{ facit.}$$

What's the Decimal of 9 oz. the Integer a lb Troy ?

$$i. e. \frac{1}{16} 16)9,00(,56 \text{ facit.}$$

Note. If the given Parts are of several Denominations, they may be reduc'd either by so many distinct Operations as there are different Parts, or by first reducing them into their lowest Denomination, and then one Division will serve. See both Ways in the

Examples.

Reduce 14 s. 9 d. $\frac{3}{4}$ into Decimal Parts of a Pound Sterling : By the first Way there will be these three Vulgar Fractions to be chang'd, $\frac{1}{20}$, $\frac{9}{240}$, and $\frac{3}{320}$.

$$20)14,00(,70$$

$$560)3,0000(,0031$$

$$\underline{1200}$$

$$240$$

$$240)9,0000(,0375$$

$$\underline{1800}$$

$$\underline{1200}$$

$$100$$

$$,70$$

$$,0375$$

$$,0031$$

$$\text{facit } ,7406$$

s. d.

The other Way. 14 9 $\frac{1}{4}$ being reduc'd to Farthings.

12

177

4

will be 711

which divided
by its Deno-
minator,

960)711,0000(.7406 is produc'd, as
(before..

3900

.6000

240

What Decimal Parts of a C. are equal to 3 qrs. 18 lb.

By the first Way:

$\frac{1}{4}$ and $\frac{11}{12}$

4)3,00(.75

112)18,0000(.1607

,1607

.680

,9107 facit.

.800

16

By the second Way:

qrs. lb

3 18

28

112)102,0000(.9107

120

102

.800

112 Denominator

16

There.

There is also another Way of reducing Parts of different Denominations, into Decimals of the highest Integer; thus,

Rule.

Bring the lowest Parts into Decimals of the next superior Denomination; and on the right Hand of the Decimal found, place the Parts given of that said next superior Denomination; so proceeding, 'till you bring out the Decimal Parts of the highest Integer requir'd, by still dividing the Product by the next superior Denominator; for Examples, take those before given, viz.

Reduce 14s. 9d. $\frac{3}{4}$ into Decimal Parts of a Pound Sterling.

$$\begin{array}{r|l}
 4 & 3 \\
 \hline
 12 & 9,75 \\
 \hline
 20 & 14,8125 \\
 \hline
 & ,7406
 \end{array}$$

Here the 3 Farthings being divided by 4, gives 75, to which the 9d. being prefix'd, it becomes 9,75; which divided again by 12, quotes ,8125; before which the 14s. being also plac'd, it makes 14,8125; which being lastly divided by 20, the Quotient ,7406, is the Answer.

What Decimal Parts of a C. are equal to 3 qrs. 18 lb?

$$\begin{array}{r|l}
 28 \left\{ \begin{array}{l} 7 \\ 4 \end{array} \right. & 18, \\
 \hline
 & 2,5714 \\
 \hline
 4 & 3,6428 \\
 \hline
 & ,9167
 \end{array}$$

Note.

Note. Instead of dividing by 28, which would be troublesome, 'tis better to divide by 7 and 4, as in the Example, 4 times 7 being 28.

Thus you see how easily the Decimals, answering to any given Parts of Coin, Weight, Measure, &c. are found; and after the same manner are the following Tables form'd.

But Shillings, Pence, and Farthings, may more readily be reduc'd thus:

Rule.

For the Shillings, (if their Number be even) set down their Half in the first Place of Decimals, and let the second and third Places be fill'd up with the Farthings contain'd in the remaining Pence and Farthings, always remembering to add one when the Number is, or exceeds 25; but if the Number of Shillings be odd, the second Place of Decimals must also be increas'd by 5.

Thus the Decimal of 8*s.* 5*d.* $\frac{1}{2}$ will be ,422, 4, in the first Place of Decimals, standing for 8*s.* and 22 Farthings being 5*d.* $\frac{1}{2}$

Again 8*s.* 6*d.* $\frac{1}{2}$ will be ,427 1 being added to 26, the Number of Farthings in 6 $\frac{1}{2}$, because exceeding 25.

But, lastly, 9*s.* 6*d.* $\frac{1}{2}$ will be thus express'd by Decimals, viz. ,477.

5 being added to the second Place, because the Number of Shillings is odd, the Decimal of 1 Shilling being ,05.

The second Sort of Reduction, is to value a Decimal by the known Parts of its Integer; which is thus done:

Rule.

Multiply the Decimal given, by the known Parts of the next inferior Denomination, and ordering the Product

Product as directed in Multiplication, still multiply the remaining Decimals by the known Parts of the next inferior Denomination; thus proceeding 'till you have brought it into the least known Parts of the Integer, the Figures standing on the left of the separating Points, will be the Parts requir'd.

Examples.

Ex. 1. What's the Value of ,7691, the Integer a Pound Sterling. (i. e.) What Shillings, Pence, and Farthings, are equal to ,765 Parts of a Pound Sterling?

,7691 Parts of a Pound
multiply'd by 20 the Shillings in 1 £.

produces Shillings, 15,3820 and Parts of a Shill.
which multiply'd by 12 the Pence in 1 Shill.

makes Pence 4,5840 and Parts of a Penny,
which again multiply'd by 4 the Farthings in 1 d.

gives Farthings 2,3360 and Parts of a Farth.

So that the Value of ,7691 Decimal Parts of a Pound Sterling, is 15 s. 4 d. $\frac{1}{2}$.

Ex. 2.

Ex. 2. What Ounces, Pennyweights, and Grains, are equal to ,84362 Decimal Parts of a Pound Troy?

Multiply'd by $\begin{array}{r} ,84362 \text{ Parts of a Pound Troy.} \\ 12 \text{ the Ounces in 1 Pound.} \end{array}$

Gives Ounces 10,12344 and Parts of 1 Ounce.

Multiply'd by $\begin{array}{r} 20 \text{ the Pennyweights in 1 oz.} \end{array}$

Gives Pennyweights 2,46880 and Parts of 1 Pennywt.

Multiply'd by $\begin{array}{r} 24 \text{ the Grains in 1 Pennywt.} \end{array}$

$\begin{array}{r} 187520 \\ 93760 \end{array}$

Gives Grains 11,25120 and Parts of one Grain.

The Answer therefore is 10 oz. 2 dwts. 11 grs.

But the Decimal Parts of a Pound Sterling, may be thus valu'd at Sight.

Rule.

The Figure standing in the first Place of Decimals; doubled, gives Shillings; but if the Figure in the 2d Place, is, or exceeds 5, one more must be added to their Number; the second Figure (if under 5) or its Excess, (if above 5) join'd with the third, are so many Farthings; only remember to abate 1 if their Number exceeds 24, or 2, if above 40.

Examples.

Ex. 1. What's the Value of ,375 Parts of a Pound Sterling?

Answer, 7 s. 6d.

the 3 doubled is 6 Shillings, to which 1 s. being added for the 5, in the second Place, makes it 7 s. and 2 remaining, join'd with the 5 in the 3d Place, being accounted 25 Farthings, from which 1 being deducted,

Q

because

because above 24, there remains 24 Farthings, or 6 Pence.

Ex. 2. What's the Value of ,846 Parts of a Pound?

Answer, 16s. 11 d.

the 8 doubled, making 16s. and 2 abated from the 46 Farthings, leaves 44 Farthings, or 11 d.

Thus are shewn the Ways both of finding the Decimals answerable to any given Parts of Coin, Weight, Measure, &c. Or the Value of any given Decimal in the known Parts of its Integer.

What follows, are TABLES ready calculated by the foregoing Rules, answering to the same Ends.





Decimal Tables

Coin & Weight

Table 1 st				Table 2 ^d		Table 3 ^d	
Coin				Troy Weight		Avoirdupoise	
1 £ster: y ^e . Integer				1 lb. the Integer		112 lb. y ^e . Integer.	
S	Dec:	S	Dec:	Ounces	Decim:	Quarters	Decim:
19	.95	9	.45	11	.916666	3	.75
18	.9	8	.4	10	.833333	2	.5
17	.85	7	.35	9	.75	1	.25
16	.8	6	.3	8	.666666	Pounds	Decim:
15	.75	5	.25	7	.583333	20	
14	.7	4	.2	6	.5	10	
13	.65	3	.15	5	.416666	9	
12	.6	2	.1	4	.333333	8	
11	.55	1	.05	3	.25	7	
10	.5			2	.166666	6	
				1	.083333	5	
				Note. This Table of Oz: will also serve for Inches Months or Days		4	
						3	
				Penny n ^o .	Decim:	2	.017857
				10	.041666	1	.008928
Pence	Decim:			9	.0375	Ounces.	Decim:
11	.045833			8	.033333	10	
10	.041666			7	.029166	9	
9	.0375			6	.025	8	
8	.033333			5	.020833	7	
7	.029166			4	.016666	6	
6	.025			3	.0125	5	
5	.020833			2	.008333	4	
4	.016666			1	.004166	3	
3	.0125					2	
2	.008333			Grains	Decim:	1	.000558
1	.004166			20	.003472	Drams	Decim:
				10	.001736	10	
				9	.001562	9	
				8	.001389	8	
				7	.001215	7	
				6	.001042	6	
				5	.000868	5	
				4	.000694	4	
				3	.000521	3	
				2	.000347	2	
				1	.000173	1	
				$\frac{1}{2}$	.000086	$\frac{1}{2}$	
Farthings	Decim:						
3	.003125						
2	.002083						
1	.001042						

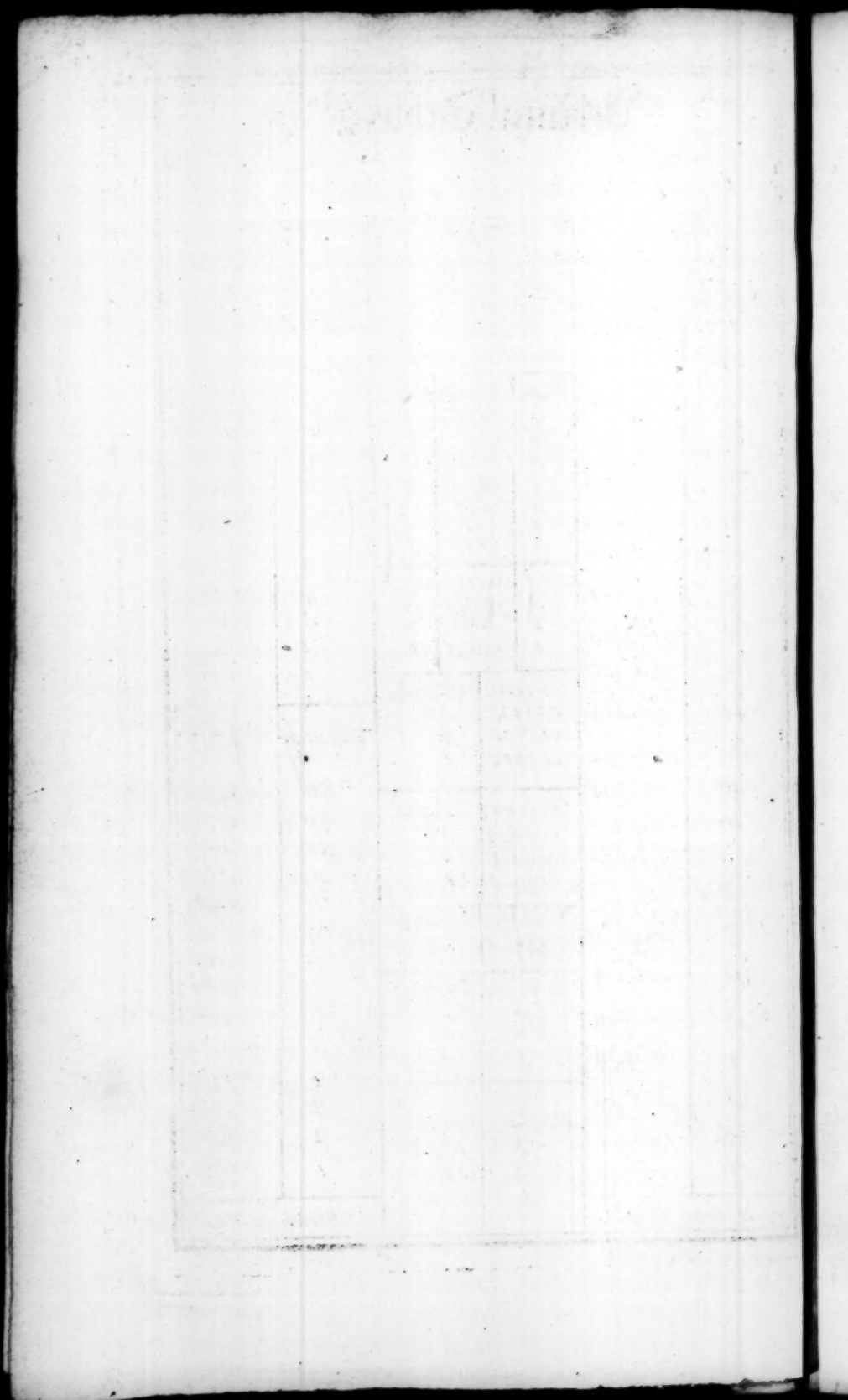
Webster scripsit.

Bickham Sculpit.

Decimal Tables

of Measure and Time

Table 4. th		Table 5. th			Table 6. th	
Time 1 year if Integer		Measure Liquid. Dry. Integer			Time 1 Day if Integer	
Days	Decim:	1 Gall:	1 Quarter		Hours	Decim:
300	.821918	Pints	Decim:	Bush.	20	.833333
200	.547945	7	.875	7	10	.416666
100	.273973	6	.75	6	9	.375
90	.246375	5	.625	5	8	.333333
80	.219178	4	.5	4	7	.291666
70	.191781	3	.375	3	6	.25
60	.164383	2	.25	2	5	.208333
50	.136986	1	.125	1	4	.166666
40	.109589	q. ^{rs}	Decim:	Pecks	3	.125
30	.082192	3	.09375	3	2	.083333
20	.054794	2	.0625	2	1	.041666
10	.027397	1	.03125	1		
9	.024657	Decim:	q. ^{rs} Pecks		Minutes	Decim:
8	.021918	.023437	3		50	.034722
7	.019178	.015625	2		40	.027777
6	.016438	.007812	1		30	.020833
5	.013699	Decim:	Pints		20	.013888
4	.010959	.005859	3		10	.006944
3	.008219	.003906	2		9	.00625
2	.005479	.001953	1		8	.005555
1	.002739				7	.004861
		Cloth Measure			6	.004166
		1 Yard if Integer			5	.003472
		Quarters	Decim:		4	.002777
		3	.75		3	.002083
		2	.5		2	.001388
		1	.25		1	.000694
		Nails	Decim:			
		3	.1875			
		2	.125			
		1	.0625			
Webster scrip. ^t					Bickham scul. ^t	



The Use of the foregoing Tables, is very plain, one Column in each Table containing the Number of Shillings, Ounces, Drams, Pints, Bushels, Days, Hours, or any thing else you may want. And against the said Number, in the other Column, the Decimal Parts answering. Thus against 3 in the first Table, is found ,0125, and against 40 Days in the fourth Table, ,109589.

But if the Number you want is not to be found in the said Tables (many compound Numbers having been omitted, to reduce them into so narrow a Compass) you must add the Parts of such two or three Numbers together, as will compose it, and the Total will be the Decimal sought. Thus, if the Decimal of 17 Penny-weights, the Integer a Pound Troy, were to be sought in the 2d Table ,041666 the Decimal of 10 Penny-weights, and ,029166 the Decimal of 7 Penny-weights, being added together, the Total ,070832 will be found the Answer; or, if in Table the fourth, you would find the Decimal of 352 Days,

$$\begin{array}{r} \text{add } ,821918 \\ ,136986 \\ ,005479 \\ \hline \end{array} \left. \begin{array}{l} \text{the} \\ \text{Decimals} \\ \text{of} \end{array} \right\} \begin{array}{l} \{ 300 \\ 50 \\ 2 \} \end{array} \text{Days}$$

give ,964383 answering 352

and so of any other.



C H A P. III.

The R U L E of T H R E E

THIS Rule having been already sufficiently explain'd, both as to its Nature and Operation in Vulgar Arithmetick, 'tis needless to repeat here what has been there said. Only therefore observe, that instead of preparing your Numbers, by reducing them into their lowest Denomination, you must now bring their Fractional Parts into Decimals. See the

Examples.

Ex. 1. If the Price of 26 Yards and $\frac{1}{2}$ of Drugget is 3 £ . 16 s . 3 d . what will 32 Yards and $\frac{1}{4}$ come to?

The Fractional Parts of the Numbers being reduc'd to Decimals, and the Question stated as usual, the Work will stand as follows:

Decimal Arithmetick.

21

$$\begin{array}{r} \text{Yards.} \\ \text{If } 26,5 \text{ --- } 3,8125 \text{ --- } 32,25 \\ \underline{32,25} \end{array}$$

$$\begin{array}{r} 190625 \\ 76250 \\ 76250 \\ \underline{114375} \end{array}$$

The Quotient, va-
lu'd by the short Rule
for Money, makes 4*l.*
12*s.* 6*d.* $\frac{1}{2}$

$$\begin{array}{r} 26,5)122,953125(4,63974 \\ \underline{1695} \end{array}$$

$$\begin{array}{r} 1053 \\ \underline{} \end{array}$$

$$\begin{array}{r} 2581 \\ \underline{} \end{array}$$

$$\begin{array}{r} 1962 \\ \underline{} \end{array}$$

$$\begin{array}{r} 1075 \\ \underline{} \end{array}$$

$$\begin{array}{r} 115 \\ \underline{} \end{array}$$

Ex. 2. What will the Pay of 540 Men amount to at
3*l.* 5*s.* 8*d.* per Man.

Man.	l.	Mens.
If 1	1,275	540
	540	
	51000	
	6375	

Answer, 688,500 or 688*l.* 10*s.*

For more Examples, take those given in Vulgar A-
rithmetick.



The Indirect RULE of THREE

IS also the same here as in Vulgar Arithmetick, differing only in the Preparation of the Numbers.

Example.

What must the Penny-Loaf weigh, when Wheat is 10s. the Bushel, if, when at 6s. 8d. per Bushel, the Penny-Loaf weighs 5 oz. $\frac{1}{2}$

If 1033333 — 5,5 —,5
5,5

166665
166665

oz. dwts. grs.
Answ. 3 13 7

25)1,833335(
3,66663

Take

Take also one Example in the DOUBLE RULE.

If the Carriage of $\frac{1}{2}$ a C. wt. 40 Miles, comes to 6 d. what will be the Charge of carrying 16 C. $\frac{1}{4}$ 100 Miles?

First, if $5 \text{ --- } .025 \text{ --- } 16.25$
 $\phantom{5 \text{ --- } } .025$

3025

8125

3250

25), 40625(

Miles.

Then if 40 ————— ,8125 ——— 100
100

100

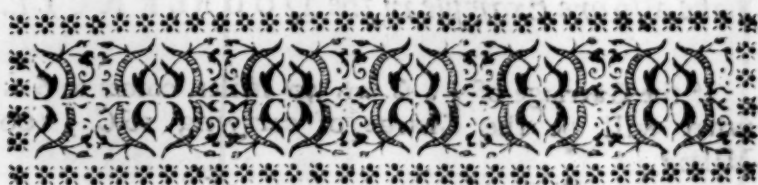
40) 81,2500(

facit 2,03125

or,

2l. 0s. 7d. $\frac{1}{2}$





C H A P. IV.

P R A C T I C E.

SOME Questions in this Rule may also be advantageously work'd by Decimals, as

1st, When the given Price is just two Shillings, 'tis only separating the right Hand Figure for a Decimal, the rest are Pounds, so in the

Example.

5295 lb, at 2s. per lb, comes to $\left\{ \begin{array}{l} 529,5 \\ \text{or} \\ 529\text{l. } 10\text{s.} \end{array} \right.$

2^d. When the Price is any aliquot Part of 2s. 'tis only separating the right Hand Figure, as before, and then dividing the Number by such Part.

Example.

oz.	d.	
258,3	at 8 d. per oz.	
8 $\frac{1}{3}$	86,1 facit,	or 86 2

3^d. When

3d. When the given Price can be divided into aliquot Parts of two Shillings, separate as before, and take such Parts.

Example.

	lb	d.
d.	563,8	at 9 per lb
6 $\frac{1}{4}$	140,95	
3 $\frac{1}{2}$	70,475	

facit 211,425 or 211 l. 8 s. 6 d.

4th. When the Price is any Number of Shillings whatsoever, 'tis only multiplying by their half, (which is the Decimal of them) and the Product is the Answer.

Examples.

lb	s.
7296	at 12 per lb
,6	

facit 4377,6 or 4377 l. 12 s.

oz.	s.
8264	at 15 per oz.
,75	

41320
57848

l. 6198,00 facit.

5th. The requir'd Price of any Quantity may be found, by multiplying the said Quantity by the Decimal of the Price given.

Example.

Example.

lb $l.$ $s.$ $d.$ per lb
 8397 at 5 13 6 per lb
 5,675

41985
 38779
 50382
 41985

facit 47652,975 or 47652 $l.$ 19 $s.$ 6 $d.$

Note. If there are Fractional Parts in the given Quantity, they must be reduc'd to Decimals, as well as the Fractional Parts of the Price, as in the following

Examples.

lb $s.$
 368 $\frac{1}{2}$ at 13 $s.$ per lb .

368,5
 ,65

18425
 22110

facit 239,525
 or,
 239 $l.$ 10 $s.$ 6 $d.$

C. qrs. lb $l.$ $s.$ $d.$
 7368 3 14 at 1 12 6.

7368,875
 1,625

36844375

14737750

44213250

7368875

facit 11974,421875
 or,

11974 $l.$ 8 $s.$ 5 $d.$ $\frac{1}{4}$

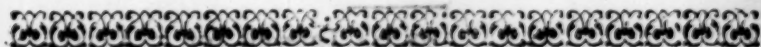
The Questions propos'd in Vulgar Arithmetick, will here also serve for more Examples.



CHAP. V.

Interest and Rebate.

THESE Rules having been already sufficiently explain'd in *Vulgar Arithmetick*, it only now remains to shew how much more advantagiously they may be work'd by Decimals. And first,



Simple Interest.

THE Annual Interest of any Sum of Money is found by only multiplying the given Principal by the Interest of one Pound for a Year, which

$$\text{at } \left\{ \begin{array}{c} 4 \\ 5 \\ 6 \end{array} \right\} \text{ per Cent. is } \left\{ \begin{array}{c} ,04 \\ ,05 \\ ,06 \end{array} \right.$$

found by dividing the Rate of Interest by 100.

Examples.

Examples.

1st. What's a Year's Interest of 536 ^{l.} at 5 per Cent.
₅₀₅

facit 26,80 or 26^{l.} 16^{s.}

2^d. What will the Interest of 2367 ^{l.} come to in a Year, at 6^{l.} per Cent. per Annum? ₅₀₆

facit 142,02 or 142^{l.} 0^{s.} 5^{d.}

Thus a Year's Interest of any Sum being found, 'tis only multiplying that Sum by 2, 3, 4, &c. and the Product is the Interest of the said Sum for 2, 3, 4 or more Years.

Example.

What is the Interest of 623 for 3 Years, at 4 per Cent.
₅₀₄

24,94 Interest for 1 Year.

3

74,82
 or } Interest for 3 Years
 74^{l.} 16^{s.} 5^{d.}

Again, if the Time requir'd, be Months, 'tis only dividing the Year's Amount by such Parts as the given Months are of a Year.

Examples.

Examples.

Ex. 1st. What is the Interest of 539 *l.* for four Months, at 5 *l.* per Cent. per Annum?

	$\begin{array}{r} \textit{l.} \\ 539 \\ .05 \\ \hline 26,95 \end{array}$	
		Interest for a Year.
<i>Months</i>	$\begin{array}{r} 4 \frac{1}{2} \\ \hline 8,9833 \end{array}$	
	or	
		8 <i>l.</i> 19 <i>s.</i> 5 <i>d.</i> $\frac{1}{2}$.

Ex. 2^d. What will the Interest of 729 *l.* 10 *s.* 6 *d.* come to in a Year and five Months, at 6 per Cent. per Annum?

Note, If there are any odd Shillings, Pence, and Farthings in the principal Sum, they must be reduc'd to Decimals, as in this Example.

	$\begin{array}{r} \textit{l.} \\ 729,525 \\ .06 \\ \hline \end{array}$	
		Interest for a Year.
<i>Months</i>	$\begin{array}{r} 43,77150 \\ 14,59050 \\ 3,647625 \\ \hline \end{array}$	Interest for 4 Months. Interest for 1 Month.
<i>facit</i>	$\begin{array}{r} 62,009625 \\ \hline \end{array}$	Total Interest.
	or	
		62 <i>l.</i> 0 <i>s.</i> 2 <i>d.</i> $\frac{1}{4}$.

But if it is requir'd to find the Interest of a Sum of Money for any Number of Days, you must either multiply the Year's Amount by the Number of Days propos'd, and divide the Product by 365, or (which will be sometimes shorter) divide the Year's Amount

R

by

by 365, and multiply the Quotient by the Number of Days propos'd.

Example.

What Interest will $\frac{1}{100}$ amount to in 126 Days, at 6 $\frac{1}{100}$ per Cent. per An.

$$\begin{array}{r}
 33,78 \quad 365)33,78000(.09254 \\
 \underline{126} \\
 20268 \\
 \underline{6756} \\
 3378 \\
 \underline{365)4256,28(11,661} \\
 290 \\
 309254 \\
 126 \\
 55524 \\
 18508 \\
 9254 \\
 11,66004 \\
 380 \\
 15
 \end{array}$$

But for the more ready casting up the Interest of Money for Days, it will be necessary to have the Interest of 1 $\frac{1}{100}$ for 1 Day, at all Rates ready calculated, as a Table or Standard. Thus

The INTEREST of 1 l. for 1 Day.

At	1	per Cent. is	,00002739726
	2		,00005479452
	3		,00008219178
	4		,00010958904
	5		,00013698630
	6		,00016438356
	7		,00019178082
	8		,00021917808
	9		,00024657534
	10		,00027397260

The Interest of 1 l. for 1 Day, is thus found; the given Rate or Interest of 100 l. for a Year, being divided by 100, quotes the Interest of 1 l. for a Year; which again divided by 365, gives the requir'd Interest of 1 l. for 1 Day; which, when multiply'd into both the Number of Days, and the principal Sum, produces the Interest for the Time requir'd.

Example.

What's the Interest of 560 l. for 60 Days, at 5 l. per Cent. per Annum?

,0001369863
560 Principal.

82191780

6349315

767123280

60 Days.

Facit 4,6027396800 or 4 l. 12 s. 0 d. $\frac{1}{2}$.

The Year being divided into 12 unequal Months, the following old Verses may serve as a *Memorandum* of the Number of Days in each, viz.

*Thirty Days hath September,
April, June, and November;
February hath twenty eight alone,
All the rest have thirty one.*

But without any farther Trouble, the annex'd Table shews, by Inspection only, the Number of Days from any Day in any Month, to the same Day in any other Month. As suppose the Number of Days, betwixt the 4th of *February* and the 4th of *September*, were requir'd, looking in the Column under *February* for *September*, against that Month will stand 212, the Number of Days betwixt the said Times; so again, from the 8th of *June* to the 8th of *October*, appears by the Table to be 122 Days, that being the Number against *October*, in the Column under *June*.

Note, If the given Days are different, 'tis only adding, or subtracting their Inequality to, or from the tabular Number. Thus had the first Example been from the 4th of *February*, to the 8th of *September*, it had been 4 Days more than 212, viz. 216; or had the Time, in the last Example, been from the 8th of *June*, to the 4th of *October*, it had been 4 Days less than 122, viz. 118.

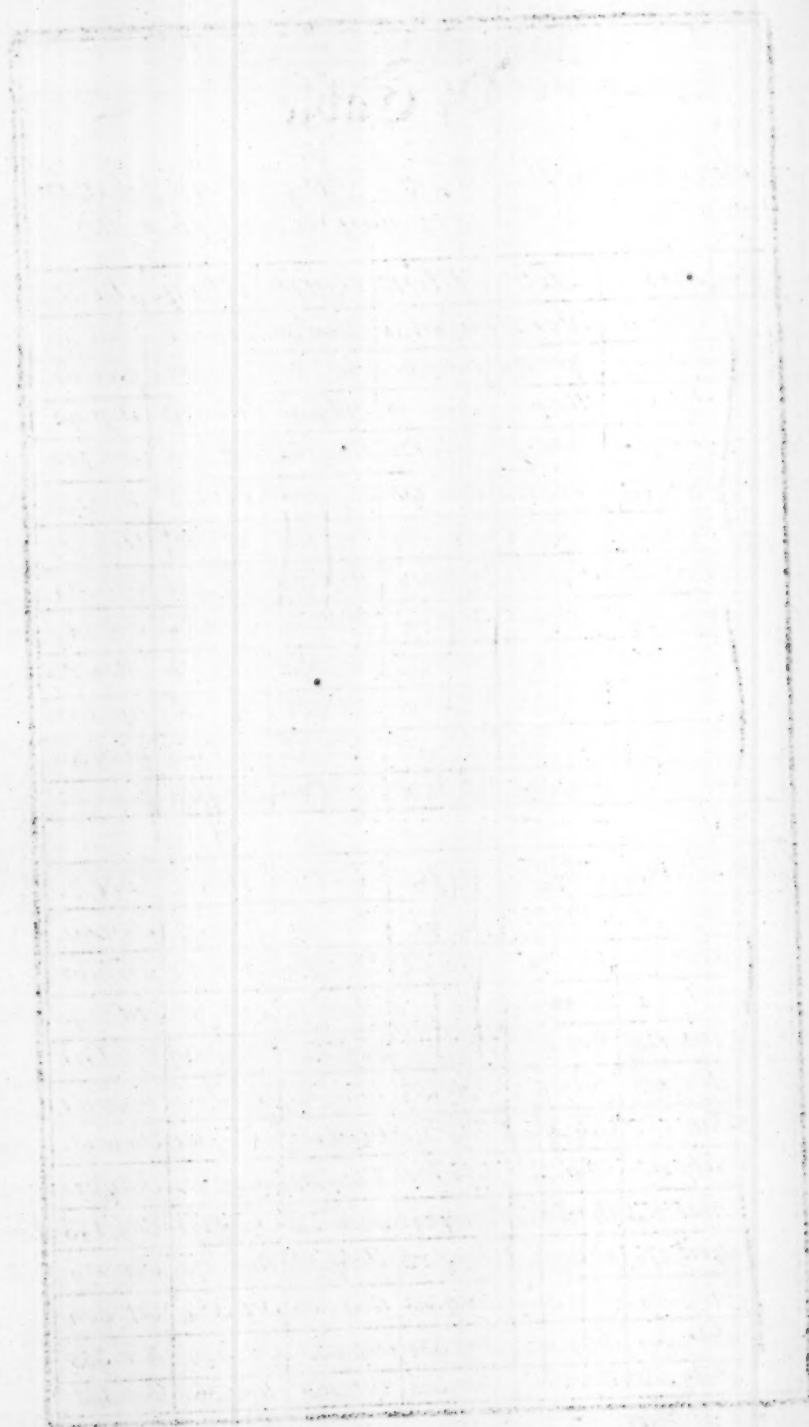
Note also, If the Time exceeds a Year, 365 Days must be added. Thus from the 4th of *February* 1714, to the 4th of *September* 1715, will be found to be 577 Days, the Sum of 212, and 365. See the Table.

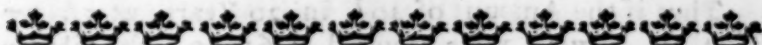
A Table

Shewing the Number of Days from any day in any Month to the same day in any other Month.

From	Jan:	Feb:	Mar:	April:	May:	June:
To	Feb: 31	Mar: 28	April: 31	May: 30	June: 31	July: 30
	Mar: 59	April: 59	May: 61	June: 61	July: 61	Aug: 61
	April: 90	May: 89	June: 92	July: 91	Aug: 92	Sep: 92
	May: 120	June: 120	July: 122	Aug: 122	Sep: 123	Oct: 122
	June: 151	July: 150	Aug: 153	Sep: 153	Oct: 153	Nov: 153
	July: 181	Aug: 181	Sep: 184	Oct: 183	Nov: 184	Dec: 183
	Aug: 212	Sep: 212	Oct: 214	Nov: 214	Dec: 214	Jan: 214
	Sep: 243	Oct: 242	Nov: 245	Dec: 244	Jan: 245	Feb: 245
	Oct: 273	Nov: 273	Dec: 275	Jan: 275	Feb: 276	Mar: 273
	Nov: 304	Dec: 303	Jan: 306	Feb: 306	Mar: 304	April: 304
	Dec: 334	Jan: 334	Feb: 337	Mar: 334	April: 335	May: 334
	Jan: 365	Feb: 365	Mar: 365	April: 365	May: 365	June: 365

From	July:	Aug:	Sep:	Oct:	Nov:	Dec:
To	Aug: 31	Sep: 31	Oct: 31	Nov: 31	Dec: 30	Jan: 31
	Sep: 62	Oct: 61	Nov: 61	Dec: 61	Jan: 61	Feb: 62
	Oct: 92	Nov: 92	Dec: 91	Jan: 92	Feb: 92	Mar: 90
	Nov: 123	Dec: 122	Jan: 122	Feb: 123	Mar: 120	April: 121
	Dec: 153	Jan: 153	Feb: 153	Mar: 151	April: 151	May: 151
	Jan: 184	Feb: 184	Mar: 181	April: 182	May: 181	June: 182
	Feb: 215	Mar: 212	April: 212	May: 212	June: 212	July: 212
	Mar: 243	April: 243	May: 242	June: 243	July: 242	Aug: 243
	April: 274	May: 273	June: 273	July: 273	Aug: 273	Sep: 274
	May: 304	June: 304	July: 303	Aug: 304	Sep: 304	Oct: 304
	June: 335	July: 334	Aug: 334	Sep: 335	Oct: 334	Nov: 335
	July: 365	Aug: 365	Sep: 365	Oct: 365	Nov: 365	Dec: 365





Compound Interest.

1st. **T**O find the Amount of any Sum, at any Rate of Compound Interest, for any Number of Years:

Rule.

Multiply the Rate, that is, the Amount of 1*l*. for 1 Year (which, at 6 per Cent. is 1,06; at 5 per Cent. 1,05, &c.) so often into itself, as are the Number of Years propos'd, wanting one; and the last Product, multiply'd by the Principal, will give the Amount requir'd.

Example.

What's the Amount of 500 *l*. forborn four Years, at 4*l*. per Cent. per Annum?

$$\begin{array}{r}
 1,04 \\
 1,04 \\
 \hline
 1,0816 \\
 1,04 \\
 \hline
 1,124864 \\
 1,04 \\
 \hline
 500
 \end{array}$$

facit 584,92928000

And thus is the first Interest-Table (which shews the Amount of 1*l*. for any Number of Years, under 33, at the Rates of 5 and 6*l*. per Cent. per Annum) form'd.

The Use of which is plain and easy; for multiplying the Figures standing against the Number of Years requir'd; and under the given Rate, by the propos'd Principal, the Product is the Amount desir'd.

R 3

Thus

Thus if the Amount of 40*l.* in 20 Years, at 5*l.* *per Cent. per Annum*, were requir'd, 2,65329, the tabular Number, multiply'd by 40*l.* the principal Sum, gives 106,13160, or 106 *l.* 2*s.* 7*d.* $\frac{1}{2}$, the *Answer*. And so any other.

2*d.* To find the Amount of any Annuity, or yearly Pension, forborn any Number of Years whatsoever, at any Rate of Compound Interest.

Rule.

Multiply the first yearly Payment by the Rate, and to the Product add the second yearly Payment, the Sum is the Amount in 2 Years; which, multiply'd again by the Rate, the Product, with the Addition of the third yearly Payment, is the Amount for 3 Years, &c.

Example.

What will a Pension of 30*l.* *per Annum* amount to, being forborn 4 Years, at 5*l.* *per Cent. per Annum*?

1.

First yearly Payment 30
multiply'd by the Rate 1,05

31,50

Second yearly Paym. added 30

gives 61,50 the Amount in 2
1,05 (Years.

64,5750

Third yearly Payment 30

94,5750 Amount in 3 Yrs.
1,05

99,303750

Fourth yearly Payment 30

129,303750 Amount in 4 Yrs.

And after this Manner is the second Interest Table (which shews the Amount of 1*l.* Annuity for any Number of Years under 33, at the Rates of 5 and 6*l.* per Cent. per Annum, Compound Interest) compos'd.

But this second Table may more easily be form'd from the first, thus: The first Line of this second Table, or first Year's Amount being known, add to it the first Line of the first Table, the Sum is the Amount for 2 Years, or the second Line of this Table; to which again adding the second Line of the first Table, you have the third of this, or the Amount for three Years, &c.

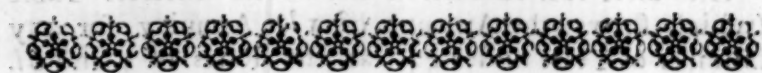
Example at 6*l.* per Cent.

1.		
1,	_____	First Year of the second Table.
1,06	_____	First Year of the first Table.
2,06	_____	Second Year of the second Table.
1,1236	_____	Second Year of the first.
3,1836	_____	Third Year of the second.
1,19101	_____	Third Year of the first
4,37461	_____	Fourth Year of the second, &c.

The Use of this second Table is in the same Manner as the first, as suppose the foregoing Question for an

Example.

4,31012 { the Amount of 1*l.* Annuity for 4
 multiply'd by 30 { Years, at 5*l.* per Cent.
 the Yearly Sum,
 gives 129,30360 as before.



REBATE, or DISCOMPT.

REBATE, according to Simple Interest, having been sufficiently explain'd in Vulgar Arithmetick, I shall only add here, as a Table, or Standard, the Discompt of 1*l.* for 1 Day, at all Rates, from 1 to 10*l. per Cent.* which is found by dividing the annual Interest of 1*l.* by 1*l.* added to its Interest, and that Quotient by 365; thus, at 1 *per Cent.*, or the Interest of 1*l.* for a Year, divided by 1,01, quotes ,00990099, the Discompt of 1*l.* for one Year; which again divided by 365, quotes ,000027126, the Discompt of 1*l.* for one Day. So that

The Discompt of 1 <i>l.</i> for 1 Day, at	1	} per Cent. is {	,0000271260
	2		,0000537201
	3		,0000797978
	4		,0001053740
	5		,0001304631
	6		,0001550788
	7		,0001792344
	8		,0002029426
	9		,0002262159
	10		,0002490660

To find the Discompt of any Sum by this Table, multiply the Figures standing against the Rate of Interest propos'd, by the principal Sum, and the Product by the Number of Days requir'd, and you have the Discompt demanded.

Example.

Example.

What Discompt must be allow'd on a Bill of 600*l.* paid 40 Days before it is due, Rebate being made after the Rate of 6*l.* per Cent. per Annum ?

30001550788—Discompt of 1*l.* for 1 Day.

600—Principal

300,0930472800

40 Days

Ans. 357218912000 Discompt of 600*l.* for 40 Days.



REBATE at Compound Interest.

1st. **T**O find the present Worth of any Sum to be paid at any Number of Years to come, Rebate being made at any Rate of Compound Interest.

Rule.

Divide the Principal continually so many times by the Rate, as are the Number of Years propos'd, and the last Quotient is the Answer.

Example.

What is the present Worth of 1*l.* to be paid at the End of 6 Years, Rebate at 6*l.* per Cent. per Annum, Compound Interest ?

		Yrs.	
The Principal 1,	1.		
,943396	Divided by 1,06 the Rate, gives	$\left\{ \begin{array}{l} ,943396 \\ ,889997 \\ ,839619 \\ ,792094 \\ ,747258 \\ ,704960 \end{array} \right\}$	$\left\{ \begin{array}{l} \text{Present Worth} \\ \text{at the End of} \end{array} \right\}$
,889997			
,839619			
,792094			
,747258			
			$\left\{ \begin{array}{l} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \end{array} \right\}$

And thus is the third Table made, which shews the present Worth of 1 *l.* due at any Number of Years to come, under 33, Rebate at 5 and 6 *l. per Cent. per Annum*, Compound Interest; the Use of which is, as the other Tables, only by multiplying the present Worth of 1 *l.* by the given Principal, and the Product is the present Worth requir'd.

Thus suppose in the Example above, the Principal had been 200 *l.* the present Worth of 1 *l. viz.* ,704960 multiply'd by 200, gives 140,992000, the present Worth of 200 *l.* and so any other.

2d. To find the present Worth of any Annuity, or yearly Pension, to continue any Number of Years; Rebate being made at any Rate, *per Cent. per Annum*, Compound Interest.

Rule.

Find by the foregoing Rule the present Worth of the propos'd Annuity, for 1, 2, 3, or so many Years as are demanded; and the Sum of those respective present Worths will be the Value of the Annuity; that is, the first and second of those Values, added together, will be the present Worth for two Years; and the first, second, and third, added, for three Years, &c.

Example.

Example.

What's the present Worth of an Annuity of 50*l.* to continue four Years, Rebate at 5*l.* per Cent. per Annum?

1.

$$\begin{array}{r} 50, \\ 47,61904 \\ 45,35147 \\ 43,19187 \end{array} \left. \begin{array}{l} \\ \\ \text{Divided by } 1,05 \\ \text{the Rate, gives} \end{array} \right\} \begin{array}{r} 47,61904 \\ 45,35147 \\ 43,19187 \\ 41,13152 \end{array}$$

The Total of which is 177,29750 the present (Worth requir'd.

And after this Manner is made Table the fourth, which shews the present Worth of 1*l.* Annuity, to continue any Number of Years under 33, Rebate at 5 and 6*l.* per Cent. per Annum, Compound Interest. Which Table, as the others. will give the present Worth of any Sum whatsoever, by only multiplying the Value of 1*l.* by the Sum propos'd. Thus suppose the foregoing

Example.

3,54595 the present Worth of 1*l.* for 4 Years, multiply'd by 50 the Annuity propos'd,

gives 177,29750 as before.

The fourth Table may be also form'd from the second, thus;

The first Year is the same in both; the first and second Years of the second, added together, make the second of the fourth; the second Year of the fourth, added to the third Year of the second, makes the third of the fourth Table, &c. See the

Example

Example at 6 l. per Cent.

,94339* The first Year of both Tables.
 ,88999 The second Year of the second Table.

1,83339 The second Year of the fourth.
 ,83961 The third Year of the second.

2,67300 The third Year of the fourth,
 &c.

* Note 1 must be added to the right Hand Figures for the Places omitted.



DECI.

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78	Chapter LXXVII
79	Chapter LXXVIII
80	Chapter LXXIX
81	Chapter LXXX
82	Chapter LXXXI
83	Chapter LXXXII
84	Chapter LXXXIII
85	Chapter LXXXIV
86	Chapter LXXXV
87	Chapter LXXXVI
88	Chapter LXXXVII
89	Chapter LXXXVIII
90	Chapter LXXXIX
91	Chapter LXXXX
92	Chapter LXXXXI
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Decimal Tables

shewing

TABLE 1. *The Amount of one Pound for any Number of Years under 33, at 4th Rates of 5 & 6 p^{ct} p^{an}. Com. Inter.*

TABLE 2. *The Amount of 1st Annuity for any number of years under 33, at 4th Rates of 5 & 6 p^{ct} p^{an}. Com. Interest.*

5	6	Years	5	6
1,05000	1,06000	1	1,00000	1,00000
1,10250	1,12360	2	2,05000	2,06000
1,15762	1,19101	3	3,15250	3,18360
1,21550	1,26247	4	4,31012	4,37461
1,27628	1,33822	5	5,52563	5,63709
1,34009	1,41852	6	6,80191	6,97532
1,40710	1,50363	7	8,14200	8,39383
1,47745	1,59384	8	9,54910	9,89746
1,55132	1,68948	9	11,02656	11,49131
1,62889	1,79084	10	12,57789	13,18079
1,71034	1,89829	11	14,20678	14,97164
1,79585	2,01219	12	15,91712	16,86994
1,88565	2,13292	13	17,71298	18,88213
1,97993	2,26090	14	19,59863	21,01506
2,07892	2,39635	15	21,57856	23,27597
2,18287	2,54035	16	23,65749	25,67252
2,29201	2,69277	17	25,84036	28,21288
2,40662	2,85434	18	28,13238	30,90565
2,52695	3,02559	19	30,53900	33,75999
2,65329	3,20713	20	33,06595	36,78559
2,78596	3,39956	21	35,71925	39,99272
2,92526	3,60353	22	38,50521	43,39229
3,07152	3,81975	23	41,43047	46,99582
3,22510	4,04893	24	44,50199	50,81557
3,38635	4,29187	25	47,72709	54,86451
3,55567	4,54938	26	51,11345	59,15638
3,73345	4,82234	27	54,66912	63,70576
3,92013	5,11168	28	58,40258	68,52811
4,11613	5,41838	29	62,32271	73,63979
4,32194	5,74349	30	66,43884	79,05818
4,53804	6,08810	31	70,76079	84,80167
4,76494	6,45338	32	75,29883	90,88977

Decimal Tables

shewing

TABLE 3 The present Worth of 1 £ due at any number of years to come under 33. Rebate at 5 & 6 per Cent. per An. Com. Interest
TABLE 4 The present Worth of 1 £ Annuity to continue any number of Years under 33. Rebate at 5 & 6 per Cent. per An. Com. Interest

Rates		years	Rates	
5	6		5	6
.952381	.943396	1	0.95238	0.94339
.907030	.889996	2	1.85941	1.83339
.863838	.839619	3	2.72324	2.67301
.822702	.792093	4	3.54595	3.46510
.783526	.747258	5	4.32947	4.21236
.746215	.704960	6	5.07569	4.91732
.710682	.665057	7	5.78637	5.58238
.676839	.627412	8	6.46321	6.20979
.644609	.591898	9	7.10782	6.80169
.613913	.558394	10	7.72173	7.36008
.584679	.526787	11	8.30641	7.88687
.556837	.496969	12	8.86325	8.38384
.530321	.468839	13	9.39357	8.85268
.505068	.442301	14	9.89864	9.29498
.481017	.417265	15	10.37965	9.71225
.458111	.393647	16	10.83777	10.10589
.436296	.371364	17	11.27406	10.47726
.415520	.350343	18	11.68958	10.82760
.395734	.330513	19	12.08532	11.15811
.376889	.311804	20	12.46221	11.46992
.358942	.294155	21	12.82115	11.76407
.341849	.277505	22	13.16300	12.04158
.325571	.261797	23	13.48857	12.30338
.310067	.246978	24	13.79864	12.55035
.295302	.232998	25	14.09394	12.78335
.281240	.219810	26	14.37518	13.00316
.267848	.207368	27	14.64303	13.21053
.255093	.195630	28	14.89812	13.40616
.242946	.184556	29	15.14107	13.59072
.231377	.174110	30	15.37245	13.76483
.220359	.164254	31	15.59281	13.92908
.209865	.154956	32	15.80267	14.08404

More Examples for the Exercise of the foregoing Rules and Tables.

Ex. 1st. What will 1000 *l.* increase to, forborn 12 Years, at 5 per Cent. *per Annum* compound Interest?

Answer, 2925 *l.* 5 *s.* 3 *d.* $\frac{1}{4}$.

Ex. 2^d. What would an Annuity of 520 *l.* forborn 17 Years, at 6 per Cent. compound Interest, amount to?

Answer, 14670 *l.* 13 *s.* 11 *d.* $\frac{1}{4}$.

Ex. 3^d. What present Money would discharge a Debt of 7500 *l.* to be paid at the End of 10 Years, Rebate being made at 5 *l.* per Cent. *per Annum*?

Answer, 4604 *l.* 6 *s.* 11 *d.* $\frac{1}{4}$.

Ex. 4th. What is a yearly Rent of 65 *l.* to continue 30 Years, worth in ready Money, Rebate being made at 6 per Cent. *per Annum* compound Interest?

Answer, 894 *l.* 14 *s.* 3 *d.* $\frac{1}{2}$.

Ex. 5th. What is the present Worth of a Reversion of a Lease of 500 *l.* *per Annum*, to continue 20 Years, but not to commence till after the End of five Years, allowing the Purchaser 6 per Cent. compound Interest?

Note, To work Questions of this Nature, there must be two distinct Operations, *viz.*

1st. The present Worth of the propos'd Annuity, for the given Time of its Continuance, must be found as if it were immediately to commence. Then,

2^d. See what Principal, forborn at the given Interest, would, in the Time of the Reversion, amount to the aforesaid present Worth, and that Principal will be the present Worth of such Annuity in Reversion.

Thus by Table the 4th, the present Worth of 1 *l.* *per Annum*, to continue 20 Years, at 6 *l. per Cent.* is found to be

which multiply'd by the propos'd } Annuity, —————	11,46992 500
gives	5734,96000

Then in the first Table, against 5 Years, the Time of the Reversion, under the same Rate of Interest, is found 1,41852 the Amount of 1 *l.* in the said Time; therefore

If 1,41852 arise from 1 *l.* from what Principal does 573496 arise?

Answer, 4042,917, or 4042 *l.* 18*s.* 4*d.* $\frac{1}{4}$.



Of purchasing Freehold Estates.

TO find the present Worth of any annual Rent to continue for ever, commonly call'd Fee-Simple.

Rule.

Divide the propos'd Rent by the Interest of 1 *l.* for one Year, (which at 5 *l. per Cent.* is .05, or at 6 *per Cent.* .06, as before shewn) and the Quotient is the present Value of the Estate.

Example.

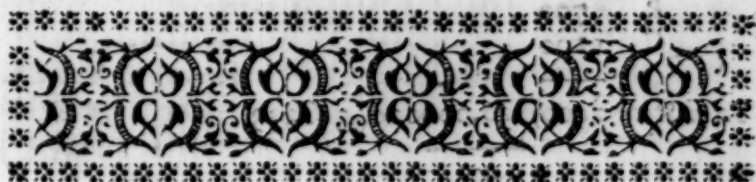
What is an Estate of 200 *l. per Annum*, to continue for ever, worth in ready Money, allowing the Purchaser 5 *l. per Cent. per Annum* compound Interest?

2. *A* agrees with *B* for an Annuity of 600*l.* per Annum, to continue 25 Years, to give him the present Worth of it, at 6*l.* per Cent. per Annum; but not having Money enough by him, offers to make over to him a Freehold-Estate of 12*l.* per Annum at the same Interest, what Money besides will pay his Purchase?

Answer, 7470*l.* os. 3*d.* $\frac{1}{4}$.



C H A P.



C H A P. VI.

FELLOWSHIP.

Without taking any Notice of the common Way of working this Rule, observe this much more compendious Method.

Rule.

Divide the whole Gain, or Loss, by the whole Stock, and multiply the Quotient by each Man's particular Stock, the several Products are the respective Gains of each.

Note, It is necessary to place so many Cyphers on the right Hand of your Dividend, as will bring out six or seven Places of Decimals in the Quotient.

Example.

Suppose *A*, *B*, and *C* trading together, *A* puts in 500*l*. *B* 700*l*. and *C* 1200*l*. their whole Gain is 836*l*. what Share of it belongs to each?

$$\begin{array}{r}
 \text{l.} \\
 2. \ A \quad 500 \\
 \quad B \quad 700 \\
 \quad C \quad 1200 \\
 \hline
 \end{array}$$

Total Stock 2400)836,000000(,348333

11600

20000

..8000

.8000

.8000

.800

348333

500

348333

700

348333

1200

A's Share 174,166500 B's 243,833100 C's 417,999600
 B's Share 243,833100
 C's Share 417,999600

Total Gain 835,999200, or 836l. as near as can be.

See another Example with Time.

A puts into Company 525l. 10s. for six Months, B
 382l. 15s. for eight Months, and C 1000l. for four
 Months; they gain'd in all ~~1280~~ how much
 is that for each?

1280

	525,5 6	382,75 8	1000 4
A's Stock	3153,0	3062,00	4000
B's Stock	3062		
C's Stock	4000		

10215)1286,6000000(,125952

,125952	,125952	,125952
3153	3062	4000

A's Gain	397,126656	385,665024	303,808000
B's	385,665024		
C's	503,808000		

Total 1286,599680 or 1286 $\frac{1}{2}$ 12s. as near as can be.

Extraction of the SQUARE ROOT



Square Numbers are either single or compound.
CHAP.
 A single Number is always less than two, be-
 ing produced by the Multiplication of some one single
 Figure by itself, as 2 from 4. Or 3 from 9. Or 4 from 16.
 Or 5 from 25. Or 6 from 36. Or 7 from 49. Or 8 from 64.
 Or 9 from 81. Or 10 from 100. Or 11 from 121. Or 12 from 144.
 Or 13 from 169. Or 14 from 196. Or 15 from 225. Or 16 from 256.
 Or 17 from 289. Or 18 from 324. Or 19 from 361. Or 20 from 400.
 Or 21 from 441. Or 22 from 484. Or 23 from 529. Or 24 from 576.
 Or 25 from 625. Or 26 from 676. Or 27 from 729. Or 28 from 784.
 Or 29 from 841. Or 30 from 900. Or 31 from 961. Or 32 from 1024.
 Or 33 from 1089. Or 34 from 1156. Or 35 from 1225. Or 36 from 1296.
 Or 37 from 1369. Or 38 from 1444. Or 39 from 1521. Or 40 from 1600.
 Or 41 from 1681. Or 42 from 1764. Or 43 from 1849. Or 44 from 1936.
 Or 45 from 2025. Or 46 from 2116. Or 47 from 2209. Or 48 from 2304.
 Or 49 from 2401. Or 50 from 2500. Or 51 from 2601. Or 52 from 2704.
 Or 53 from 2809. Or 54 from 2916. Or 55 from 3025. Or 56 from 3136.
 Or 57 from 3249. Or 58 from 3364. Or 59 from 3481. Or 60 from 3600.
 Or 61 from 3721. Or 62 from 3844. Or 63 from 3969. Or 64 from 4096.
 Or 65 from 4225. Or 66 from 4356. Or 67 from 4489. Or 68 from 4624.
 Or 69 from 4761. Or 70 from 4900. Or 71 from 5041. Or 72 from 5184.
 Or 73 from 5329. Or 74 from 5476. Or 75 from 5625. Or 76 from 5776.
 Or 77 from 5929. Or 78 from 6084. Or 79 from 6241. Or 80 from 6400.
 Or 81 from 6561. Or 82 from 6724. Or 83 from 6889. Or 84 from 7056.
 Or 85 from 7225. Or 86 from 7396. Or 87 from 7569. Or 88 from 7744.
 Or 89 from 7921. Or 90 from 8100. Or 91 from 8281. Or 92 from 8464.
 Or 93 from 8649. Or 94 from 8836. Or 95 from 9025. Or 96 from 9216.
 Or 97 from 9409. Or 98 from 9604. Or 99 from 9801. Or 100 from 10000.



C H A. P. VII.

Extraction of the R O O T S.

Extraction of the S Q U A R E R O O T

IS finding what Number, multiply'd by it self, will produce the Number given, which is always supposed a Square Number, that is, one great Square composed of many small ones, as in the following Figure, containing nine small Squares, the Side or Root of which, is 3.



Square Numbers are either single or compound.

A single Square Number is always less than 100, being produc'd by the Multiplication of some one single Figure by itself, as 16 from 4, &c. So that the Root of
any

any single Square may be found in the annex'd Table, always taking the Root of the next less Square, for any Number not there inserted, as for 26 take 5, or 3 for 10, &c.

Squares	1	4	9	16	25	36	49	64	81
Roots	1	2	3	4	5	6	7	8	9

A compound Square Number being compos'd by the Multiplication of two or more Figures by themselves, always exceeds 100; as 144, which is 12 times 12; or 195, which is 15 times 15, &c.

Therefore, to find the Root of any compound Square Number, as suppose 2704,

1st. You must distinguish it into single Squares, by placing Dots over every other Figure, beginning at the right Hand, thus,

2704.

And so many Dots as happen, so many Places will the Root consist of, which in this Example are two.

2^{dly}. Drawing a crooked Line on the right Hand of your Number, as in Division, find the Root of your first single Square, and place it in the Quotient. See the Work :

2704(5

3^{dly}. Placing the Square of the Root found, under the first single Square, subtract, and set down the Remainder; bringing down to it the next single Square, call the Line a *Resolvend*.

If the Divisor, multiply'd by the Quotient-Figure, gives a Product greater than the Resolvend, the said Quotient-Figure must be rectify'd by a smaller one.

204 *Resolvend*:

4^{thly}:

4thly. Drawing another crooked Line on the left Hand of the said Resolvend, place beyond it the Double of the Quotient, in Form of a Divisor.

$$\begin{array}{r} 2704 \overline{) 5} \\ 25 \\ \hline \end{array}$$

$$25$$

$$10) \cdot 204$$

5thly. Dividing the Resolvend, all but the Unit's Place, by the said Divisor, (which, in this Example, is the 10's in 20) set down the Number of Times it goes, (viz. 2) both in the Quotient, and on the right Hand of the Divisor :

$$\begin{array}{r} 2704 \overline{) 52} \\ 25 \\ \hline \end{array}$$

$$25$$

$$102) 204 R.$$

6thly. Multiplying the whole Divisor by the Figure last plac'd in the Quotient, set down the Product under, and subtract it from the Resolvend, See the Work.

$$\begin{array}{r} 2704 \overline{) 52} \\ 25 \\ \hline \end{array}$$

$$25$$

$$102) 204$$

$$204$$

$$\cdot 0$$

Note.

If the Divisor, multiply'd by the Quotient-Figure, gives a Product greater than the Resolvend, 'tis false, and must be rectify'd by a smaller Quotient-Figure.

Note also, As many single Squares as are in the Number propos'd, so many times must the Work of the three last Rules be repeated; every Square being to be brought down, as directed in the third Rule.

Example.

What's the Root of 582169(763 *Answer.*

$$\begin{array}{r}
 49 \\
 \hline
 146 \overline{) 921} \text{ Resolv.} \\
 \underline{876} \\
 1523 \overline{) 4569} \text{ Resolvend.} \\
 \underline{4569} \\
 0
 \end{array}$$

In this Example, to 45 the second Remainder, 69 the next Square, being brought down, make 4569 a new Resolvend; and 76, the Quotient-Figures, being doubled for a new Divisor, make 152, which going three times in the Resolvend, 3 is plac'd both in the Quotient, and on the right Hand of the Divisor, which being then multiply'd by 3, gives 4569, equal to the Resolvend; so that nothing remains.

The Proof of this Extraction, is only multiplying the Root found by it-self, which, if right, will produce the Square Number given. Note, if any thing remains, it must be taken in.

To find the Fractional Part of the Root, add to the Number given, a competent Number of Pairs of Cyphers, and proceed by the foregoing Rules: As suppose 75896 were given for an

Example.

Example.

$$\begin{array}{r} 75896,000000(275,492 \\ 4 \end{array}$$

$$\begin{array}{r} 47)358 \\ 329 \end{array}$$

$$\begin{array}{r} 545)2996 \\ 2725 \end{array}$$

$$\begin{array}{r} 5504)27100 \\ 22016 \end{array}$$

$$\begin{array}{r} 55089)508400 \\ 495801 \end{array}$$

$$\begin{array}{r} 550982)1259900 \\ 1101964 \end{array}$$

$$\cdot 157936$$

Note, As many Pairs of Cyphers as are added, so many Places of Decimal Parts will there be in the Root.

To extract the Square Root of a Fraction.

Find the Root of the Numerator for a Numerator; and let the Root of the Denominator be its Denominator; thus the Square-Root of $\frac{1}{4}$ is $\frac{1}{2}$, and of $\frac{4}{9}$ is $\frac{2}{3}$, &c.

The Root of a mix'd Number is also found after the same Manner, being first reduc'd into an improper Fraction; thus $6\frac{1}{4}$, reduc'd, makes $2\frac{5}{4}$, the Root of which is $\frac{5}{2}$, or $2\frac{1}{2}$.

But if either a proper Fraction, or a mix'd Number, be incommensurable to its Root, to extract it, reduce the Fraction to a Decimal of an even Number of Places,

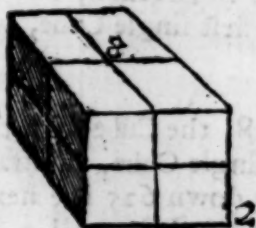
ces, and extract the Root as if it were a whole Number, thus $\frac{7}{8}$, reduc'd to a Decimal, will be .8750, the Square Root of which is .935, &c. or had it been $4\frac{7}{8}$, which, reduc'd, is 4.8750, the Root would be 2.935, &c.

Extraction of the CUBE ROOT

IS finding what Number, multiply'd twice into its self, will produce the Number given; thus the Cube Root of 64 is 4, 4 times 4 being 16, and 4 times 16 making 64.

What a Cube is, may be something explain'd by the following Figure, wherein 8 Dice are so dispos'd, that there are 2 every Way, that is, 2 in Length, 2 in Breadth, and 2 in Height; so that 8 is the Cube, and 2 the Root.

See the Figure.



Cube-Numbers are either single or compound.

A single Cube Number is always less than 1000, being produc'd by the Multiplication of one single Figure, first by itself, and then by its Product, as 125 from 5, &c. so that the Root of any single Cube may be found in the annex'd Table; always remembering to take the Root of the next less Cube for any Number not there inserted, as for 513 take 8, or 6 for 220, &c.

T

Cubes

Cubes	1	8	27	64	125	216	343	512	729
Squares	1	4	9	16	25	36	49	64	81
Roots	1	2	3	4	5	6	7	8	9

A Compound-Cube Number being compos'd by the Multiplication of 2 or more Figures, first by themselves, and then by their Product, always exceeds 1000, as 1728 from 12, or 15625 from 25, &c.

Therefore to find the Root of any Compound Cube-Number, as suppose 15625.

1st. You must distinguish it into single Cubes, by placing Dots over every third Figure, beginning from the right Hand, thus

15625

and so many Dots as happen, so many Places will the Root consist of, which, in this Example, are two.

2^{dly}. Drawing a crooked Line on the right Hand of your Number, as in Division, set down as a Quotient the Root of your first single Cube, which, in this Example, is 2.

3^{dly}. Placing 8, the Cube of 2 the Root found, under 15 the first single Cube, subtract, and to the Remainder 7 bring down 625 the next single Cube, and it will make 7625, which call a Resolvend. See the Work:

15625(2
8

7625 Resolvend.

4^{thly}.

4^{thly}. Draw a Line under the Resolvend, and tripling the Square of the Root 2, set the said triple Square (*viz.* 12) under the Resolvend; so that Units in the said triple Square may stand under the Place of Hundreds in the Resolvend.

5^{thly}. Subscribe also the Triple of the Root 2 (*viz.* 6) so that Units, in this, may stand under the Place of Tens in the Resolvend.

6^{thly}. The triple Square of the Root, and triple Root, being plac'd as directed, draw a Line under them, and add them together in the Order they are plac'd; the Sum 126 is a Divisor.

7^{thly}. Accompting all the Resolvend (except the Place of Units, *viz.* 762) a Dividend, seek how often the Divisor (126) is contain'd in it, and place the Number of Times (which is here 5) in the Quotient.

8^{thly}. Draw a Line under the Divisor, and multiplying the triple Square (12) by 5, the Figure 1st plac'd in the Quotient, set the Product (60) so under the said triple Square, that Units may stand under Units, and Tens under Tens.

9^{thly}. Squaring the Figure (5) last plac'd in the Quotient, multiply its Square (*viz.* 25) by the triple Root (6), and place the Product (150) so that Units, in this, may stand under Units in the said triple Number.

10^{thly}. Subscribe the Cube of (5) the Figure last plac'd in the Quotient, which will be 125, so that Tens in this may stand under Units in the former Product.

11^{thly}. Then drawing a Line, add the three Numbers last plac'd together, and subtracting the Sum (7625,

which is call'd the Ablatitium) from the Resolvend, set down the Remainder (if any) in order underneath, as in common Subtraction. See the Work:

$$\begin{array}{r}
 15625(25 \\
 \underline{8} \\
 7625 \text{ Resolvend.} \\
 \underline{12} \\
 6 \\
 \underline{126} \text{ Divisor.} \\
 60 \\
 150 \\
 125 \\
 \underline{7625} \text{ Ablatitium,}
 \end{array}$$

Note, If the given Number hath more Places, the next single Cube must be brought down to the last Remainder, for a new Resolvend, and the Work of the 4th, 5th, 6th, 7th, 8th, 9th, 10th, and 11th Rules, must be again repeated; and so as often as you form a new Resolvend.

Note also, If the Ablatitium is greater than the Resolvend, the Work is false, and must be rectify'd by placing a lesser Figure in the Quotient.

The Proof of this Extraction, is by multiplying the Root found, first by it self, and that Product again by the Root, adding the Remainder, if there be any, to the last Product; thus,

25 the Root,
multiply'd by 25.

125

50

gives 625
again by 25 the Root,

3125

1250

gives 15625

To find the Fractional Part of the Root, add to the Number given, so many Ternaries of Cyphers, as you would have Places of Decimal Parts in the Root, and proceed by the foregoing Rules. As suppose 865635 were given for an

T 3

Example.

Example.

865635,000000(94)99

729

136635 Resolvend.

243

27

5257 Divisor.

972

432

64

101584 Ablatitium.

35051000 Resolvend.

26508

282

265361 Divisor.

238572

22842

719

24086349 Ablatitium.

10964651000 Resolvend.

2701803

2847

27020877 Divisor.

24316227

230607

729

2433929499 Ablatitium.

8530721501

In this Example, there being two Ternaries of Cyphers, the Root must have two Decimal Places,

The

The Cube-Root of a vulgar Fraction is found after the same Manner as the Square Root, viz. by finding the Root of the Numerator given, for a new Numerator, and the Root of the Denominator given, for a new Denominator,

Also if the Vulgar Fraction be incommensurable, it must be reduc'd to a Decimal, as directed in the Square Root, and then extracted.

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Division
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